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CEMENTS

PASTES, GLUES, AND GUMS

A PRACTICAL GUIDE TO THE MANUFACTURE AND APPLICATION OF THE VARIOUS AGGLUTINANTS REQUIRED IN THE BUILDING, METAL-WORKING, WOOD-WORKING, AND LEATHER-WORKING TRADES, AND FOR WORKSHOP, LABORATORY, OR OFFICE USE

With upwards of Nine Hundred Recipes and Formulæ

COMPILED BY

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AUTHOR OF "THE ARTIST'S MANUAL OF PIGMENTS," "THE PRACTICAL POLISH AND VARNISH MAKER," ETC.

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PREFACE.

WITH the object of putting into the hands of manufacturers, workmen, and amateur mechanics a collection of reliable recipes for Cements, Glues, Pastes, &c., for a wide variety of purposes, I have gathered up what is given in this volume. Those recipes which I have not had occasion to make use of in practice I have critically examined, and I offer them, fully convinced that when tried they will not be found wanting in efficacy.

In some few cases the same recipe will be found on more than one page, perhaps not in precisely the same words, but the formula is the same. This I have deemed advisable, so that, should a particular recipe (say, for joining leather to wood) be sought for in the section of recipes for Leather-workers, the searcher should not be disappointed by failing to find it in such section, and omitting to look for it among the recipes for Wood-workers, in which case he might condemn the book undeservedly as not containing what he expected to find.

The arrangement of the work into sections applicable to various crafts—as for Metal-workers, Wood-workers, &c.—will, I think, be found more useful for reference than if the recipes

were alphabetically but promiscuously arranged without any such classification.

The need of such a work as the present is evident from the astonishing fact—of which I have confirmation almost daily—that even manufacturers, and those of all classes, are very often ignorant of the methods of preparing some of the simplest of the materials required in their manufacturing processes. To take an example not connected with the subject-matter of this volume, a boot-manufacturer will turn out several thousands of pairs of ready-made boots every week, each boot requiring the heel, waist, and sole-edges to be blacked with a special kind of ink (technically known as burnishing ink); yet, instead of preparing this article himself—an article which he uses in hundreds of gallons, and which is easily, quickly, and cheaply made—he is content to buy his supplies from one of the few manufacturers of this specialty. So largely is this article in demand that several American firms export their burnishing inks to England for the use of the English boot-manufacturer, who thus stands at the loss of freightage and ink-manufacturer's profit on an article that he could easily make for himself at one-twentieth of the cost. Nor is this the case with one only of the preparations needed in the manufacture of boots and shoes.

I have the less hesitation in drawing attention to this ignorance on the part of many manufacturers of necessary details appertaining to their particular industries, because much of the information they require might be gleaned from technical works or their own trade journals; but, anomalous as it may seem, the very persons for whom technical books are written are often ignorant of the very existence of such means of instruction, while their foremen or work-people will be found jealously guarding from the prying eyes of fellow-workers the "trade secrets" of which they have become possessed. Thus

these so-called "trade secrets" are locked up in the heads of a few men, or, if published, are as often as not known only to the intelligent amateur, who becomes acquainted with them as a student of technical works.

Many of the recipes, however, given in trade journals are totally unreliable. This is due to the editorial acumen exercised in "lifting" a recipe from a rival journal, the formula being appropriated without inquiry into its merits, although it may be clothed in fresh words so as to give the recipe the appearance of a new one. Printers' blunders, allowed to pass through editorial ignorance or carelessness, are also responsible for the untrustworthiness of many published recipes. A striking example of such a blunder, now before me, gives instructions for producing an imitation vermilion pigment. The basis of the pigment is redlead, and the vermilion tone is imparted to the base by the addition of eosin, an aniline dye. I first noticed this recipe some ten years ago, but I have frequently come across it since in various trade journals with the word "eosin" printed "resin"—obviously a printer's error, unrectified by editorial supervision in the first instance, and repeated time after time by the exercisers of the scissors and paste!

Trusting that the present volume will find a place on the office-shelves—not to stay there unopened—of many a manufacturer, and be often seen in the hands of both working and amateur craftsmen, I leave my readers to judge of its usefulness.

H. C. S.

GRAVELLY HILL, BIRMINGHAM.

CONTENTS.

INTRODUCTION.

RECIPES.

HINTS ON THE APPLICATION OF CEMENTS.

Many failures result in the application of cements, because the person who applies them is careless in following some of the directions given, or in making the cement has not been accurate in the necessary details. By observing the following simple rules much time and money may be saved :—

I. Have the surface perfectly clean; dirt and grease will prevent any cement securing perfect adherence. To clean the surface, wash the article with a lye made from caustic potash and water, or if from the nature of the article such lye would render the cement ineffectual, use bisulphide of carbon to remove all greasy matters. Ordinary dirt can be removed by soap and water; even the grease that may be on the fingers will be sufficient to prevent the cement perfectly adhering to the surface to be joined; should such grease by any means become smeared over the places to be joined therefrom, be careful how you handle the broken pieces. If the substances to be united have been joined before, all traces of the former cement must be removed.

II. Be very careful to so adjust the surfaces to be joined that they are accurately in contact according to the fractures. To secure this, it is best to heat the pieces to be joined in those cases where the cement is melted by heat. Should this simple precaution be neglected, failure is almost sure to result, because by bringing the hot cement in contact with the cold surface, the cement is cooled below its proper sticking power. However, heat expands the pores of a body, and therefore allows the cement to penetrate deeper than when applied cold, and as the pieces of the articles cool these expanded pores contract to the former dimensions, and therefore hold the cement that has thus penetrated in a firm grip.

Where solutions are used, the cement must be well rubbed

into the surfaces, either with a soft brush—in the case of china or glass a camel-hair painting brush answers well—or by rubbing the two surfaces together, as in making a glue joint between two pieces of wood.

III. It will be found best to allow as thin a layer of cement as possible to remain between the united surfaces. To secure this, the cement should be as liquid as possible (thoroughly melted if used hot), and the surfaces should be pressed closely into contact (by screws, weights, wedges, or cords) until the cement has hardened. These mechanical aids also help to displace the thin film of air which sticks to the substance. The ordinary carpenter's hand-screw is recommended for use with cement. It is in use by all cabinetmakers and carpenters for glueing. A strong tight band about the object answers the same purpose, and is good if tight. All excess should be removed from the edges while the cement is still liquid.

Plenty of time should be allowed for the cement to dry or harden, particularly with oil cements, such as copal varnish, whitelead, &c. When two surfaces, measuring each an inch across, are joined by means of a layer of whitelead placed between them, six months may elapse before the cement in the middle of the joint has become hard. In such a case a few days or weeks are of no account. At the end of a month the joint will be weak and easily separated, while at the end of two or three years it may be so firm that the material will part anywhere else than at the joint. Hence when the article is to be used immediately, the only safe cements are those which are liquefied by heat and become hard when cold. A joint made with marine glue is firm an hour after it has been made.

Next to cements that are liquefied by heat are those which consist of solutions dissolved in water or alcohol. A glue joint sets firmly in twenty-four hours; a joint made with shellac varnish becomes dry in two or three days. Oil cements which do not dry by evaporation, but harden by oxidation (boiled oil, whitelead, redlead, &c.), are the slowest of all.

IV. Colouring matters may be introduced into cement with good effect. But care should be used not to mix anything with the cement which will set up any chemical action, and so weaken the joint.

V. Before trying a recipe and giving it up in disgust if it does not immediately come up to expectation, select the most likely recipe from the lists and patiently await the result.

RECIPES.

I. ACID-PROOF, SPIRIT-PROOF, AND WATER-PROOF CEMENTS.

Acid Bottles, Cement for.

2 parts tallow, 30 parts pure rubber, 2 parts slacked lime.

Melt the tallow by the heat of a water bath, and gradually add the rubber until it is all dissolved. When thoroughly melted add the lime.

Alcohol, Cement proof against.

Take best quality glue and pour on it water equal in weight to that of the glue used. Let the glue soak overnight, and the next morning melt it at a gentle heat, and add 5 pieces of white chalk or whitelead. Mix well and add a little acetic acid, carbolic acid, oil of cloves, or other oil to prevent putrefaction.

This cement will not stand boiling water, as it is softened thereby, but it is well adapted for flexible objects like leather.

Algerian Lute.

No. 1.—1 part wood ashes, 2 parts lime, 3 parts sand, water and oil.

Mix the solids, and then pass them through a sieve and moisten the sifted mixture with water and oil, and beat up the mass with a wooden mallet till the compound has acquired the right consistence.

No. 2.—Mix ground almond cake or linseed cake with starch paste and gum water.

This lute is useful to put round the stoppers of acid bottles to prevent the shaking out of the contents while being carried about.

Benzine and Petroleum, Composition Insoluble in.

It has been discovered that gelatine mixed with glycerine yields a compound liquid when hot, but which solidifies on cooling, and forms a tough elastic substance having much the appearance and characteristic of indiarubber.

The two substances united form a mixture entirely and absolutely insoluble in petroleum or benzine, and the great problem of making casks impervious to the fluids is at once solved by brushing or painting this on the inside with the compound.

This is also used for printers' rollers and for buffers of stamps, as benzine or petroleum will clean this when dirty in the most perfect manner, and in an incredibly short space of time.

Water must not be used with this compound.

Bisulphide of Carbon, Cement impervious to.

Use best quality of white glue, with the addition of 10 per cent. of molasses stirred in.

Galvano-plastic Trough, Cement for.

No. 1.—150 parts Burgundy pitch, 27 parts guttapercha, 75 parts pounded pumice-stone.

Melt the guttapercha, mix it with the pumice-stone, and then add the pitch.

Coat the wooden vessel with this preparation and pass a hot iron over its surface to smooth it. Such a box, if of oak, will last for twelve or fifteen years as a galvanic bath, and will resist sulphate of copper baths, but not cyanides.

No. 2.—1 part pitch, 1 part resin, and 1 part of perfectly dry plaster of Paris.

Melt all together, stirring thoroughly.

No. 3.—A concentrated solution of silicate of soda with powdered glass.

Mix the concentrated solution of silicate of soda with the powdered glass to form a paste.

This cement is useful for luting joints in vessels exposed to acid fumes.

No. 4.—China clay and boiled linseed oil.

Mix the ingredients in the proportions to produce a mixture of the right consistence.

No. 5.—Quicklime and linseed oil.

Mix the ingredients stiffly, to form a hard cement which resists heat and acids.

No. 6.—Pipeclay and coal tar.

Mix to a stiff consistence.

No. 7.—According to Dr. Wagner, the following compound is *proof against even boiling acids.*

Indiarubber, tallow, dry slacked lime, redlead.

First melt the indiarubber by gentie heat, and then add to it 6 or 8 per cent. of its weight of tallow, well stirring the mixture while adding this ingredient. Next add dry slacked lime in dry powder until the mixture becomes of the consistency of soft paste. Lastly, add 20 per cent. of redlead, in order to make the mixture harden and dry.

No. 8.—100 parts sulphur, 2 parts tallow, 2 parts resin.

Melt and add sifted ground glass.

No. 9.—A lute proof against *nitric and hydrochloric acid vapour.*

1 part resin, 1 part sulphur, 2 parts brickdust.

First mix the ingredients and then melt together.

No. 10.—*Plaster Cement.*—1 part of pure rubber, 2 parts of linseed oil, 6 parts of pipeclay.

Melt the rubber in the oil at a gentle heat, then add the pipeclay. This cement, although plastic, softens by heat but does not melt.

No. 11.—48 parts resin, 8 parts dried red ochre, 4 parts calcined plaster of Paris, 6 parts linseed oil.

Melt the resin, stir in the oil, and then incorporate the other substances, well stirring until incorporated.

No. 12.—*Acid-proof lining for ordinary galvanic battery.*—4 parts resin. 1 part guttapercha, boiled oil.

Melt the guttapercha in the oil by heat, and then stir the mixture into the melted resin, and well incorporate the whole.

Have the boxes perfectly dry and the above mixture hot, then smear the inside of the boxes with it, and use a hot iron to drive the cement into the cracks and crevices.

No. 13.—Indiarubber.

Melt by heat, and run it into the joints, which will thus be rendered proof against chlorine and some acid vapours.

Kerosene Lamps, Cement for.

A cement particularly adapted for attaching the brasswork to petroleum lamps is made by boiling 3 parts resin with 1 part of caustic soda and 5 parts of water. The composition is then mixed with half of its weight of plaster of Paris. It sets firmly in a half to three-quarters of an hour.

This cement is said to be of great adhesive power, not permeable to petroleum, a low conductor of heat, and not superficially attacked by hot water. Zinc white, whitelead, or precipitated chalk may be substituted for plaster, but hardens more slowly.

Kerosene Lamps, Cement for Tops of.

24 parts lead, 16 parts tin, 20 parts bismuth.

Melt and use as solder.

Oil Tanks, Cement for.

5 parts litharge, 2 parts lime (unslaked), 2 parts quartz sand.

Mix and make into a paste with a small quantity of water.

Paraffin Lamps, Cement for.

3 parts resin, 4 parts strong lye, 5 parts water, 5 parts plaster of Paris.

Dissolve the resin in the lye until complete solution is effected, and then allow the mixture to become cold, when it forms a tenacious mass. Dilute this by adding the water, and then work the plaster of Paris carefully in.

This cement is insoluble, and is used for fastening the metal parts on paraffin lamps.

Waterproof Cements.

No. 1.—Soak pure glue in water until it is soft, then dissolve it in the smallest possible amount of proof spirits by the aid of gentle heat. In 4 oz. of this mixture dissolve 20 gr. of gum ammoniac, and while still liquid add 1 drm. of mastic dissolved in 6 drm. of rectified spirits of wine. Stir well, and for use keep the cement liquefied in a covered vessel over a hot-water bath.

No. 2.—Mix 5 parts of glue, 4 parts resin, 3 parts red ochre with a little water.

No. 3.—4 parts of shellac, 1 part borax.

Boil in a little water until dissolved, and then concentrate by heat to a paste.

No. 4.—Mix 10 parts of bisulphide of carbon and 1 part of oil of turpentine, and then dissolve as much guttapercha in the mixed fluids as it will take up.

No. 5.— 1 part tar, 1 part tallow, 1 part fine brickdust.

Warm the brickdust over a very gentle fire, then add the tallow, then the tar, and well mix the whole.

Use the cement hot.

No. 6.—4 parts good gray clay, 6 parts black oxide of manganese, 90 parts limestone reduced to powder by sprinkling it with water.

Mix altogether, calcine and powder.

No. 7.—15 parts manganese iron ore, 85 parts lime, calcined and powdered.

Both Nos. 6 and 7 require to be mixed with a little sand for use; when thrown into water they harden rapidly.

No. 8.—8 parts fine clean sand, 4 parts powdered quicklime, 1 part bone ash.

Beaten up with water for use.

No. 9.—5 parts quicklime, 6 parts fresh cheese, 1 part water.

Slake the lime by sprinkling it with water, then sift it through a sieve and add the fresh cheese. The latter is prepared by curdling milk with a little vinegar and removing the whey. The cement thus made is very strong, but it must be used at once as it sets very quickly.

No. 10.—This is used for joining stone, metal, wood, &c.

1 part fresh curds as before, 1 part quicklime, 3 parts Roman cement.

Mix as before.

No. 11.—A paste composed of hydraulic lime and soluble glass forms a good waterproof cement.

No. 12.—1 part glue, 1 part black resin, ¼ part red ochre.

Mixed with least possible quantity of water.

No. 13.—4 parts glue, 1 part boiled oil by weight, 1 part oxide of iron.

Make into a paste or thin fluid with the oil.

No. 14.—Mix a handful of quicklime with 4 oz. of linseed oil, thoroughly lixiviate the mixture, boil it to a good thickness and spread it on tin plates in the shade. It will become very hard, but it can be dissolved over a fire like common glue, and is then fit for use.

No. 15.—This is a very old formula, known as *Yates's Waterproof Glue.*

4 oz. glue, 2 oz. isinglass.

Dissolve in ale over a slow fire, then add 1½ oz. boiled linseed oil.

When required for use, dissolve in ale.

Waterproofing for Cemented Articles.

Soak the articles or surface for twenty-four hours in a solution of 1 part of copperas ("green vitriol" or ferrous sulphate) in 3 parts of water, and dry in the air. Ferric oxide is produced, which chemically combines with the cement and makes it denser, harder, heavier, and weather-proof, filling up the pores and giving it an ochre colour. Ornamental cement-work should be brushed over with the solution four times and allowed to dry.

The cement-work can be rendered extremely resisting by warming and then coating with a hot mixture of equal parts of paraffin wax and paraffin oil. This treatment is recommended as especially serviceable for ornamental cement-work which is exposed to the weather. By treating the cemented articles with a 5 per cent. solution, then drying and polishing, the surface is made receptive for oil painting.

Chalk objects and room walls treated in this manner will stand any amount of washing, especially if they be washed with a solution of alum in water after applying the solution.

Light ochre colour can be obtained by adding alum to the ferrous sulphate, and various shades of green by painting with chrome alum.

II. BUILDING CEMENTS, PLASTERS, ETC

Architectural Cement.

No. 1.—Take strong rice water, and mix therein paper that has been beaten to a pulp in boiling water, then work in enough whiting to make of the right consistence. The paper must be perfectly pulped.

No. 2.—Make the cement same as No. 1, but substitute plaster of Paris for the whiting.

Architectural Uses, Cement for.

Make a compound by melting size and stirring in whiting and paper pulp.

This is a sort of papier-maché, and must be varnished or painted if exposed to the weather.

Artificial Cement (Schottler's Formula).

6 parts (by weight) plaster of Paris (best freshly ground), 3 parts brickdust, 4 parts refinery cinders.

Grind or pound all these bodies to a fine powder, then sift through a wire sieve (so fine as not to allow mustard-seed through). Mix with water and, shortly before the cement is to be used, mix thoroughly with 2 parts of sifted iron filings. The mixture should be used as thin and soft as possible; in all other respects like ordinary mortar.

Bitumen Mortar.

Use the bitumen ground as a product in the manufacture of paraffin oil and mineral oil. (It should be thoroughly cleansed by means of acids and alcohol.)

Mix 1 part of such bitumen with 2 to 6 parts of lime mortar. This is prepared from 1 part of good slacked lime and 2 parts of sharp quartz sand. Mix this mortar and allow it to become

hard before mixing with the bitumen. It is best to melt and heat the bitumen to 140° F. before mixing with the lime.

Blast-furnace Slag Cement.

No. 1.—This cement is due to the inventive genius of Mr. Ransome, who thus converts blast-furnace slag into hydraulic cement, having even greater strength than Portland, besides being much lighter in colour. In this process granulated slag is mixed and ground with chalk or lime, or with the spent lime of the gas-works; the resulting mixture is then calcined and again ground.

The cement is found to possess high qualities both as regards quick setting and strength. When spent-gas lime is used Mr. Ransome gets rid of the sulphur with which it is saturated by mixing a certain proportion of powdered coke with the slag and lime, which in the furnace reduces the sulphate of lime present to sulphite, and passing a jet of steam through the mass, by which the sulphur is carried off as sulphuretted hydrogen, leaving pure lime behind. He has also devised a revolving retort for the calcination of his materials, by which they are prevented from caking, and a subsequent grinding rendered unnecessary.

No. 2.—Mix, calcine, and grind 2 parts blast-furnace slag, 5 parts lime, and 2 of clay.

Blood Cements.

These cements are used as a paint for brickwork.

No. 1.—50 parts slacked lime, 40 parts beaten bullock's blood, 1 part alum.

No. 2.—50 parts slacked lime, 25 parts fine ashes, 8 to 10 parts bullock's blood.

In either case mix with water.

Blood and Ash Cement.

100 parts slacked lime, 50 parts sifted coal ashes, 15 parts beaten bullock's blood.

Mix altogether. Used for filling joints between brick and building stones.

Brickdust Cement for Iron and Stone.

This cement is recommended for securing iron to stone.

Melt resin. and stir in brickdust finely ground and sifted

until a sort of putty is formed. This, however, runs easily while hot.

To use this cement, set the iron in the hole in the stone prepared to receive it, then pour in the melted putty until the hole is filled; then, if thought desirable, bits of brick previously warmed may be pushed into the mass, and a little of the cement thereby saved. As soon as the whole is cool the iron will be firmly held to the stone, and the cement is quite durable and uninjured by the weather, while, unlike lead and sulphur, it has no injurious effect on the iron.

Brick Masonry impervious to Water, To make.

Sylvester's process consists in the successive application to the walls of two washes. One consists of Castile soap and water, the other of alum and water. The preparations are, ¾ lb. of soap to 1 gallon of water, and ½ lb. of alum to 4 gallons of water.

The walls should be quite dry and clean, and the temperature of the air should not be below 50° F. The soap wash should be laid on first; it should be laid on with a flat brush at a boiling heat. After twenty-four hours the wash will be dry and hard, and the alum wash should be applied at a temperature of 60° to 70° F. This is allowed to remain for twenty-four hours, when the whole operation is repeated until the wall has become impervious to water. The number of applications required will depend on the water pressure to which the wall will be subjected.

Brown Cement.

20 parts pure gum rubber, bisulphide of carbon a sufficient quantity, 2 oz. shellac, 8 oz. alcohol.

Dissolve the rubber in the smallest possible amount of the carbon bisulphide, add this slowly to the alcohol, avoiding clots, add powdered shellac, and place the bottle in boiling water until the shellac is dissolved and no more smell of the carbon bisulphide is given off.

Building Cement.

To 1 heaped bushel of mortar, made in the ordinary way, add 3½ quarts (dry measure) of iron scales to 1½ quart of molasses.

Use this cement the same day as made.

Caseine Cement.

12 parts caseine (see p. 39), 50 parts slacked lime, 50 parts fine sand.

Mix into a paste with water.

This is a cheap cement, and is one well adapted for filling large holes in walls and joints between building stones.

Clay Cements.

No. 1.—Knead 10 parts of clay with 1 part of linseed oil.

No. 2.—50 parts clay, 1 part of powdered glass, and mix.

No. 3.—Similar to above, only replacing the glass with chalk and adding an equal amount of boracic acid.

Glass Roofs, Elastic Putty for.

Glass when set in iron frames for roofs cannot be easily kept waterproof owing to the expansion and contraction of the iron by heat. The following elastic putty, however, will remedy this evil.

Melt together 2 parts of resin and 1 of tallow, and intimately mix some whitelead. This putty, while hot, is spread upon both sides of strips of linen or cotton cloth, and these, while the putty is still warm, are pasted one half upon the iron and the other upon the glass. The strips should be about ½ inch wide.

Granite, Cement for.

Reduce marble-dust and feldspar to an impalpable powder. Melt gum dammar in the mixture by gradual heating. Apply warm to the faces of the fractured portions. The black feldspar is preferably used to prevent the detection of the joint.

Hamelin's Mastic.

This cement is applied to the purpose of covering buildings, intended to resemble stone, the surface of which should first be washed with linseed oil.

60 parts silicious sand, 40 parts Bath or Portland stone (in fine powder), 20 parts lime, 8 parts litharge, linseed oil.

Grind all the solids together, and for use mix up with the oil and use like mortar.

Hydraulic Cement (Gad's Patent).

No. 1.—3 parts of dried clay in powder, and 1 of oxide of iron made into a paste with boiled oil.

This hardens under water.

No. 2.—Mix clay, broken pottery, flint and bottle glass into a frit. Grind, sift, and mix with one-third its weight of quicklime. Keep from the air.

In using, mix into a mortar and use like pozzuolana.

Interior Decoration, Plasters for.

These are known as *fine*, *coarse*, *gauge* and *stucco*, &c.

Fine Stuff.—Slake lump lime with water to a paste and afterwards to a cream, after which it hardens by the water evaporating, and is ready for working. It is now used for what is termed slip coat, but is ready for finishing coat when prepared with plaster of Paris, or some coarse stuff.

Coarse Stuff.—2½ parts lime paste, 4½ parts sand, ⅓ part hair. There may be less hair used for the second coat.

Gauge Stuff, a hard finish. — This is composed of from 1½ to 2 parts of fine stuff and ½ part of plaster of Paris. Regulation must be considered as to the rapidity of hardening.

For cameos, &c., there will be equal parts of fine stuff and plaster.

Iron Articles in Stone, Cement for Fastening.

7 parts good plaster of Paris, 1 part iron filings.

Stir the two ingredients into a paste with water and use as soon as possible, as it dries very quickly.

Ironwork in Stone, Cement to Fasten.

For this purpose Portland cement should be used, because, being non-porous, it does not permit the iron to become rusted, which stone does, as it imbibes moisture. Lead sets up galvanic currents, especially when the acid in the air becomes washed down the iron railings into the lead whenever it rains.

Lime and Glue Cement.

Into hot glue stir unslaked lime.

This gives a good and very cheap cement.

Lyons Asphaltum.

15 parts bitumen, 35 parts coal cinders, 10 parts powdered coke, 130 parts lime, 160 parts fine gravel.

Mix the coal and bitumen in a boiler by heating the bitumen, and skim the mixture until the formation of froth ceases. Then intimately mix the powdered coke and lime, and heat the mix-

ture to 575° F. in order to dry this; then mix this compound with that in the boiler, and finally add the gravel.

Marble, Cements for Joining.

No. 1.—Take plaster of Paris, and soak it in a saturated solution of alum; then bake it in an oven, the same as gypsum is baked to make it plaster of Paris. It is used as wanted, being mixed up with water like plaster and applied. It sets into a very hard composition capable of taking a very high polish, and may be mixed into various colouring minerals to produce a cement of any colour of imitating marble.

No. 2.—8 parts of resin, 1 part of wax, 4 or 5 parts of plaster of Paris.

Melt the resin and wax, then stir in the plaster; the parts to be joined should be made hot.

No. 3.—Quicklime, fresh from a newly-burnt kiln and slaked with white of egg, will cement marble if the fractured parts are washed to make them quite clean.

No. 4.—12 parts Portland cement, 6 parts slate (slaked) lime, 6 parts fine sand, 1 part infusorial earth, silicate of soda.

Make into a thick paste with the silicate of soda; the articles do not require to be heated. This cement sets in twenty-four hours, and the fracture is not easily discernible.

No. 5.—Make a thick mucilage of 1 oz. of gum arabic, add 1½ oz. of dental plaster, and finally ½ oz. of powdered quick lime.

Mix well. Heat the marble before applying the cement.

No. 6.—Coat the marble with linseed oil, varnish, then apply the following cement: 10 parts brickdust, 1 part litharge, 2 parts linseed oil varnish; work up into a stiff putty.

No. 7.—Mix 20 parts of litharge with 19 of freshly-formed lime with linseed oil.

No. 8.—Mix shellac into marble-dust so as to imitate the colour of the marble to be repaired. Melt the mixture, and use as a cement to the fractured parts.

No. 9.—One authority gives the following:—

Begin with the raw gypsum in lumps of moderate size, burning them at the usual temperature (below red heat); the solution of alum should contain 1 part of this solution in 19

parts of water. There is no difficulty in dissolving the quantity if the water be previously heated and the alum coarsely pulverized. By immersing the lumps of burnt gypsum in this solution while they are still warm, and leaving them in about fifteen minutes, they will become thoroughly saturated with the liquid; they should then be allowed to drain and again burnt, but this time at a red heat. Gypsum which has been treated in this way forms, when pulverized, a slow-setting cement, which ultimately attains great hardness, and has frequently been used for making paving tiles, especially in Italy.

No. 10.—Chloride of zinc (virulent poison), borax or sal ammoniac, oxide of zinc.

Make a solution of the chloride of zinc of specific gravity 1·490 to 1·452, and then put in such solution 3 per cent. of borax or sal ammoniac. When this is dissolved put in the oxide of zinc (which should have been previously heated red hot and allowed to cool); the amount of oxide is proportional to the consistency of the cement desired.

This cement becomes as hard as marble, and may be used for moulding.

Masons, Cement for.

No. 1.—*For joining fragments of stone.*—20 parts clean river sand, 2 parts litharge, 1 part quicklime, and linseed oil.

Form into a thin paste with the oil.

No. 2.—*Gad's Cement* (see p. 12), used *for work required to harden under water.*

No. 3.—*For Grotto Work.*—Use commonest sealing-wax.

No. 4.—*For Foot Walks, and all uses which require exposure to the weather or to dampness.*—Make a solution of glue, and thoroughly stir therein Portland cement, so as to make a thick paste, and use it at once.

In three days a cement so made acquires an extraordinary hardness and tenacity. It is an excellent cement for joining the porcelain heads of the metal spikes which are used as ornamental nails.

No. 5.—*Hydraulic Cement.*—An authority recommends a mixture of 75 parts of carefully washed chalk and 25 parts of washed kaolin (china clay), which is first calcined to a red heat and afterwards ground. The powder is then snow white, or if the heat had been too great it has a bluish shade. Either

alone or with a small percentage of gypsum it makes an excellent hydraulic cement.

No. 6.—*For Stoneware.*—1 part yellow Botany Bay gum, and 1 part brickdust. Melt together.

No. 7.—*Fireproof Cement.*—6 parts chalk, 2 parts lime, 2 parts salt, 1 part sand (Barnsey sand is recommended), ½ part iron filings, ½ part clay. To be ground all together and calcined.

This cement, finer than Beale's, is patented as a fireproof cement.

No. 8.—*Another Hydraulic Cement.*—3 parts clay, 1 part slaked lime.

Mix, and subject to a full red heat for three hours. and then grind to powder.

Mastic Cement.

This cement is not made from mastic resin, but totally different ingredients. It is used for pointing brickwork.

60 parts slaked lime, 35 parts sand, 3 parts litharge, 7 to 10 parts old linseed oil, or linseed oil varnish.

Knead all into a stiff paste in a mortar by means of a pestle, and thoroughly work all the ingredients together.

Pen's Cement.

1 part powdered quicklime, 2 parts powdered baked clay. Mix these two together and then add 1 part of baked powdered gypsum to 2 parts of powdered baked clay, and after mix them together. Mix this compound with the first one and thoroughly incorporate the two.

This cement is used for the exterior of buildings. It is mixed with water and applied like mortar. It acquires great hardness and is very durable.

Pipes, Cement for Uniting Large.

No. 1.—1½ part Roman cement, 4 parts whitelead, 1 part litharge, ½ part resin, old linseed oil boiled with resin.

Pulverize and mix all the solids, and then mix 2½ lb. to 3 lb of the mixture with the prepared oil.

No. 2.—Equal parts of burnt lime, Roman cement, potter's clay and ordinary clay, separately well dried and finely ground, sifted, well mixed, and triturated with linseed oil

—Stoneware Pipes, Cement for.

The proper proportion for cement pipe is 1 of water cement to 3 of sand gravel. From the size of a pigeon eye down is better than fine sand, and it must be perfectly clean, and free from mould or vegetable matter.

The cement and sand must be thoroughly mixed before the water is added, and it must be used immediately after mixing. The most common cause of failure is a poor quality cement.

Plaster Casts, Cement for Hardening.

Give several coats of a saturated solution of borax or alum with a brush until the surface becomes as hard as desired; two coats generally suffice, but sometimes five or six are required. A few (generally two) coats of a hot saturated solution of chloride of barium, and a few coats of soapwater are then applied with a brush, and the surplus soap is washed off until the clear water forms beads on the surface of the cast.

Plaster Cement.

No. 1.—Take plaster of Paris, bake it and then grind it, then steep the ground plaster in a solution of alum for twenty-four hours, after which drain off the alum solution, dry the plaster in the open air and give it a second baking.

No. 2.—Better results are obtained by employing an aqueous solution containing $\frac{1}{20}$ of borate (of soda?) and $\frac{1}{20}$ of cream of tartar; the plaster, baked and in fragments, is plunged into the solution until it is saturated, then it is calcined and pulverized.

No. 3.—10 parts silicate of potash, 27 parts water, 500 may also be added.

No. 4.—Plaster of Paris busts, &c., are best mended with shellac varnish or soluble glass.

Plaster Floors, Cement for Forming.

Mix about 6 parts of good quality plaster with 1 part of freshly slacked white lime finely sifted.

Spread this mixture on the floor surface as quickly as possible, not using the trowel in it for too long a time. Then allow the floor to become very dry and afterwards be thoroughly saturated with sulphate of iron or zinc; the iron gives the strongest surface, the resistance to breaking being twenty times

the strength of ordinary plaster. With sulphate of zinc the floor remains white; but when iron sulphate is used it becomes the colour of rusted iron; but if linseed oil boiled with litharge be applied to the surface it becomes a beautiful mahogany colour; especially so is the case if a coat of copal varnish be added.

Plaster Models, to Mend.

Saturate the broken surfaces thoroughly, press them well together, and let them dry.

Plaster of Paris.

This very useful material is made by calcining calcic sulphate (gypsum) at a temperature of 500° F., by which all the water of crystallisation is expelled. This cement is useful for forming casts or moulds.

Plaster of Paris, Substitute for.

5 lb. best whiting, 2½ lb. glue, 2 lb. linseed oil.

Heat these materials and mix them thoroughly. After this compound has cooled, lay on a stone which is covered with powdered whiting, heat until the mass is tough and firm. Cover with wet cloths, and keep moist. Ornaments may be made by this material by pressing it into a mould with a screw-press. It becomes very hard after a time.

Plaster of Paris, to Cast in.

Use the finest and purest plaster of Paris.

When filling a mould learn to beat up the requisite quantity of cream quickly and with care, to avoid making it too thick. In pouring this in use a good camel-hair brush to prevent hair bubbles; a mere surface cover of this thin cream is all that is required. While doing this, have ready the thicker plaster of the consistence of light syrup and fill up the mould at once. In about twenty minutes you can open the mould if your plaster is pure and has been properly mixed. If you do not put too much oil on the object to be moulded and have used your brush properly, you will find clean sharp models.

Pointing for Buildings.

Use equal parts of hydraulic cement (Portland), lime, and fine white sand.

Putty, To Soften, when Hard.

Common putty, whether in the lump or in sashes, becomes very hard in the course of time, which renders the removal of the glass very difficult. Putty so hardened may be softened, however, by using a paste of caustic potassa; this alkaline paste is easily prepared by mixing the caustic alkali, or even carbonate of potash or soda, with equal parts of freshly-burnt quicklime which has been previously sprinkled with water so as to cause it to fall into powder; this is then mixed with water to a paste, and is spread on the putty to be softened. When one application is not sufficient it should be repeated. In order to prevent the paste from drying too quickly it is well to mix it with less water, adding some soft soap instead.

Another Method.—Mix 1 part of pearlash with 3 parts quicklime, finish slacking the lime in water, and then mix in the pearlash, making the whole to the consistence of paint. Apply this compound to both sides of the glass where the putty is, and let it remain about twelve hours, when the putty will be so softened that the glass may be removed with ease.

Another Method.—Soft soap rubbed on the hard putty pretty thick, and allowed to stand about twelve hours or more, softens putty so that it can be cut out quite easily with a knife.

Roman Cement.

The modern article consists of 6 parts ordinary clay calcined and mixed with 4 parts of lime to the mixture recalcined.

The genuine Roman consists of pulvis puteolanus, or pozzuolana, a ferruginous clay from Putioli, calcined by the fires of Vesuvius, lime and sand mixed with soft water. The only preparation which the pozzuolana undergoes is that of powdering and sifting, but the ingredients are occasionally mixed up with bullock's blood and the fat of animals, to give the composition more tenacity.

Slake a bushel of lime with a solution of 3½ lb. green copperas dissolved in 5 gallons hot water, and stir in ½ bushel of fine gravel sand; stir up the whole with a stick, and keep continually stirred while in use.

This cement is used for the fronts of buildings, and then enough for one entire front should be mixed at once, as it is difficult to match the colour again, and it ought to be used the same day as made.

Roofs, Cement for.

No. 1.—2 parts by weight of common pitch and 1 part guttapercha. Melt the two together.

This composition will be more manageable than guttapercha alone.

To repair gutters, roofs, or other surfaces, carefully clean out of the cracks all earthy matters, slightly warm the edges with a plumber's soldering iron, then pour the cement in a fluid state upon the cracks while hot, finishing up by going over the cement with a moderately hot iron, so as to make a good connection and a smooth joint. This composition will also repair zinc, lead, or iron, and is a good cement for aquariums.

No. 2.—4 lb. resin, 1 pint linseed oil, 2 oz. redlead; stir in and use sand until the proper consistence is secured, and apply warm.

This cement hardens and is elastic, durable, and waterproof.

Sandstone, Cement for.

10 parts clean sand, 1 part lead oxide, ½ part ground lime; linseed oil.

Mix into a paste or putty with the oil.

Sandstone, Cement for Repairing Articles of.

20 parts fine sand clean and dry, 2 parts plumbic oxide pulverised, 1 part lime powdered, linseed oil, or linseed oil varnish.

Mix the three solids into a paste with the oil.

Sawdust Mortar.

Sawdust, when used in mortar instead of hair, has been found good to prevent the mortar peeling off the sides of a wall, &c.

First thoroughly dry and sift the sawdust through an ordinary grain sieve to remove the larger particles, and then make the mortar by mixing 1 part of cement, 2 parts lime, 2 parts sawdust, and 5 parts sharp sand. The sawdust being first well mixed dry with the cement and sand.

Slag Cements.

No. 1.—Granulated slag is ground and mixed with lime, and the mixture calcined and reground.

No. 2.—Blast-furnace slag is mixed in the following propor-

tions with lime and clay : slag, 1 part; lime, 2½ parts; clay, 1 part. Calcine all together.

Slate, Cement for.

This is used for the joints of slate-work on roofs or in tanks. It consists of boiled linseed oil, whitelead, chalk intimately compounded and used in a fluid condition.

Stone Cement for Building Purposes.

20 parts plaster of Paris, 2 parts hydraulic lime, 1 part liquid glue, 100 parts water.

Pour into suitable-sized moulds when hard, and dry in the air for two weeks.

Stone, Cement for.

20 parts clean river sand, 2 parts litharge, 1 part quicklime, and linseed oil.

Use sufficient oil to form the mass into a thick paste.

This cement is applied to mend broken pieces of stone, and after a time it becomes exceedingly hard and strong.

Stone Troughs and Wooden Vats, Cement for.

1 part resin, 1 part yellow wax, 1 part calcined ochre in fine powder.

Melt the resin and wax together, then mix in the ochre, and heat the mass fluid for a short time. To use this cement, pour it into the joints and cracks of the stone or wood, when it forms a cement as hard as stone.

Sulphur or Brimstone Cement.

Roll sulphur is frequently used alone as a cement for fastening iron bars in holes drilled in stone. The addition of brick-dust, sand or resin lessens its liability to crack. When the yellow colour of the brimstone is an objection, a little graphite may be mixed with it.

Terra-cotta, Cement for.

10 parts resin, 10 parts yellow wax, 2 parts sulphur.

Melt the three substances together, and add 1 part each of hammer slag and quartz sand. Point off the edges of the joint with powdered terra-cotta. Coat the terra-cotta after heating. and apply the cement as soon as possible.

Tiled Roofs, Cement for.

Equal parts of dry sand and whiting, and 25 per cent. litharge made into the consistency of putty with linseed oil.

This cement is not liable to crack when cold, or melt like tar or asphalte with the heat of the sun.

Tiles on Iron, Cement for Fixing.

Use a guttapercha cement made by melting together in an iron pan 2 parts common pitch and 1 part guttapercha. Stir them well together until thoroughly incorporated, and then pour the liquid into cold water. When cold this cement is black, solid, and elastic, but it softens with heat, and at 100° F. is a thin fluid.

Transparent Cement.

According to a German journal, a very strong transparent cement applicable to wood, porcelain, stone, glass, &c., may be made by rubbing together in a mortar 2 parts of calcic nitrate, 25 parts of water, and 20 parts powdered gum arabic. The surfaces to be united are to be painted with the cement and bound together until completely dry.

No. 2.—25 parts of unvulcanised rubber, 20 parts chloroform, 3 parts mastic.

Dissolve the rubber in the chloroform and then add the mastic, and digest.

Turkish Mortar.

1 part powdered brick and tiles, 2 parts fine sifted lime; water.

Mix to the desired consistency, and pack on layers of five or six inches in thickness between the courses of bricks and stone. This mortar is used where great solidity is required in buildings.

Walls, Cement for Stopping Holes in.

Mix fine-sifted lime and plaster of Paris; when applied and dry, rub down with glass or sandpaper, spread over a level board, then dust for sizing.

Walls, Waterproof Cement for.

50 parts of pitch, 30 parts resin, 6 parts red ochre, 12 parts fine brickdust.

Boil all together with constant stirring, and then sufficient oil of turpentine—almost one quarter of the volume of the above—added to cause it to spread softly. It should be laid on as thin as possible with a brush.

Water Cement.

No. 1.—10 parts slaked lime, 19 parts brickdust, 16 parts sand, 5 parts blacksmith's dross, 5 parts powdered lime.

Mix to a paste with water.

No. 2.—6 parts iron filings, 1 part sand, 1 part powdered slaked lime.

Mix to a paste with water.

Waterglass.

When mixed with powdered chalk, makes a mortar which hardens completely in six or eight hours. When mixed with sulphide of antimony it forms a dark mass, susceptible of a high polish; with iron filings, the result is a greyish black, very hard mass; whilst with zinc filings a very hard grey metallic mass is produced. Very suitable for cementing zinc work.

Waterglass (Silicate of Soda) Cement.

By combining waterglass with cement or quicklime a double silicate, hard as stone and resisting chemical agents, is formed in a short time. Waterglass by itself can only be used for cementing glass to glass, and even for this a certain skill is required; but, combined with other substances, it furnishes a durable and hard cement.

Waterglass Cement for Hydraulic Works.

Finely powdered cement, solution of silicate of soda. Mix the two bodies quickly together.

As this cement hardens very quickly, it should be used fresh. It hardens under water, and is therefore excellent for hydraulic works. The stones should be cemented with a solution of waterglass immediately before applying the cement.

Waterglass and Lime Cement.

10 parts quicklime, 100 parts whiting, 25 parts solution of waterglass.

Mix all together. This cement hardens slowly, and one applicability of it is in mixing small sharp-edged stones and stamping it into moulds for flag or paving stones.

Waterproof Mortar.

Slake the lime with a solution of green vitriol (copperas or sulphate of iron) made by dissolving the salt in warm water and then slaking the lime in the usual manner with the solution, and finally mixing the lime with fine sand.

Weather-resisting Cement.

The following mixtures give these qualities of a very hard and durable cement capable of resisting the action of the weather. It is very suitable for cementing fractures in marble or stone statues, monuments, or ornamental work which are exposed to atmospheric influences.

No. 1.—12 parts Portland cement, 6 parts chalk paste, 6 parts fine sand, 1 part siliceous earth.

No. 2.—6 parts Portland cement, 12 parts chalk paste, 6 parts fine sand, 1 part siliceous earth.

No. 3.—9 parts Portland cement, 6 parts chalk paste, 6 parts fine sand, 1 part siliceous earth.

The above ingredients are made into a thick paste with waterglass. No. 2 gives the hardest cement.

White Cement that Hardens under Water.

25 parts of fossil meal (infusorial earth), 75 parts chalk free from iron, 25 parts solution potash or soda.

Mix into a dough, form the mass into bricks, dry them, burn in a white heat, and then grind to powder.

III. CEMENTS AND PASTES FOR CHEMISTS', ELECTRICIANS', AND NATURALISTS' USE.

Beale's Cement.

This cement is patented as fireproof:—

60 parts chalk, 20 parts lime, 20 parts salt, 10 parts sand, 5 parts iron filings or dust, 5 parts blue or red clay.

Grind all together and heat until red-hot. For use, mix with water to a paste.

Birdlime.

This preparation is a thick, soft, tough, and sticky mass, of a greenish colour, has an unpleasant smell and bitter taste, melts easily on heating, and hardens when exposed in thin layers to the air. It is difficult to dissolve in spirits of turpentine and fat oils, and also somewhat in vinegar. The best quality is prepared from the inner bark of the holly (*Ilex aquefolium*), which is boiled, then put into barrels, and submitted for fourteen days to slight fermentation until it becomes sticky.

Another process of preparing it is to mix the boiled bark with juice of mistletoe berries, and burying it in the ground until fermented, the bark is then pulverised, boiled, and washed.

—Artificial Birdlime.

Is prepared by boiling and then igniting linseed oil, or boiling printer's varnish until it is very tough and sticky. It is further prepared by dissolving cabinetmaker's glue in water and adding a concentrated solution of chloride of zinc. The mixture is very sticky, does not dry on exposure to the air, and has the advantage that it can be easily rubbed off the feathers of the bird.

Cap Cements for Electrical and Chemical Apparatus.

These are so named because they are used to fix on parts of electrical or other apparatus.

They are very useful for many purposes, and should find a place in every laboratory and amateur workshop.

No. 1.—11 oz. best white glue, 1 oz. white curd soap, 3¼ lb plaster of Paris, 2 quarts water.

The glue is put to soak over night in just enougn water to well cover it. In the morning (or when properly softened) it is dissolved, together with the soap, in the rest of the water previously heated to boiling, unless a quantity of the cement is required; a sufficient quantity of the plaster of Paris is mixed up quickly with enough of the warm liquid to form a smooth thin paste. This paste must be used at once, as it soon sets or hardens. When hardened, it is impervious to coal oil.

No. 2.—Equal weights of redlead and whitelead, used for chemical and electrical purposes. For cementing glass tubes, necks of balloons, &c., into metal mountings this is preferable to whitelead alone, and may be depended on from temperature up to 212° F.

No. 3.—5 lb. resin, 1 lb. beeswax, 1 lb. dried Venetian red.

Melted together.

No. 4.—7 lb black resin, 1 lb. red ochre, ½ lb. plaster of Paris.

Well dried and added while warm. Heat the mass to a little above 212° F., and agitate it together until all frothing ceases and the liquid runs smooth; then remove the vessel from the fire and stir the contents till sufficiently cool for use.

No. 5.—4 oz. of linseed oil added to the ingredients in No. 4.

Caseine Cement, Best.

This caseine cement is made from cheese, thus: boil freshly-made cheese in water until it dissolves to a mass which can be drawn into threads; then take 100 parts of this prepared cheese, 200 parts of water, 25 parts of slacked lime, 20 parts of wood ashes, and mix all together.

Caseine and Borax Cement.

A solution of caseine in a concentrated solution of borax, made with cold water, makes a very tenacious cement.

Caseine and Waterglass Cement.

When caseine is dissolved in soluble silicate of soda or potassium, a very strong cement, suitable for glass or porcelain, results.

Chemical Cement, or Chemical Mastic for the Laboratory.

This cement is used for the masonry of chlorine and oil of vitriol tanks, and as a lining for casks intended to hold chloride of lime.

Equal parts of pitch, resin, and plaster of Paris, thoroughly dried. Mix together.

Chemical Cement.

No. 1.—4 parts yellow wax, 2 parts common turpentine, 1 part well-dried Venetian red, or other red oxide of iron.

Melt the wax and turpentine at a moderate heat, and then stir in the red pigment.

This cement is useful, as in temporarily stopping a lute from the ends, or joints of tubes which are not exposed to much heat, as in alkilimetry.

No. 2.—Mix equal parts of wheat flour, finely-powdered Venice glass, pulverised chalk, and a small quantity of brick-dust finely ground.

These ingredients, with a little scraped lint, are to be mixed and ground up with the white of eggs. It must then be spread on pieces of fine linen cloth and applied to the crack of the glasses, and allowed to get thoroughly dry before the glasses are put to the fire.

Chemical Glasses, Cement for.

1 oz. flour, 1 oz. pulverised glass, 1 oz. pulverised chalk, ½ oz. fine brickdust, scraped lint, white of egg.

Spread on a linen cloth, and apply to the crack of the glass

Conchologists, Cement for.

5 parts gum arabic, 2 parts sugar-candy, whitelead enough to colour.

Dissolve the gum and sugar in water to a thick jelly, then

mix in the whitelead. This is used to mend shells and other specimens.

Chemical Glasses, Temporary Stopping or Lute for.

Use 4 parts of yellow wax, 2 oz. turpentine, and 1 oz. Venetian red.

Cracked Bottles, Waterglass Cement for.

Prepare a thickly fluid solution of waterglass by fusing togegether carbonate of soda and sand, and dissolve the resulting preparation in five or six times its weight of boiling water. Provide the bottle with a cork fitting tightly, but set on loosely while the bottle is heated to at least 212° F. When this is done, press down the cork so that it closes the bottle hermetically, and then apply a thick coat of the waterglass solution to the cracks. The air in the bottle, in cooling, contracts the pressure of the outer air, forces the waterglass into the cracks, closing this so perfectly that they cannot be detected.

Cracks in Glass Vessels, Cement for Stopping.

The following compound resists moisture and heat.

Dissolve caseine in a cold solution of borax.

With this solution paste strips of hog's or bullock's bladder, softened in water, on the cracks of glass, and dry at a gentle heat. If the vessel is to be heated, coat the bladder on the outside, just before it is become quite dry, with a paste of a rather concentrated solution of soda and quicklime, or plaster of Paris.

Crucible, Lutes for.

No. 1.—Make a paste of freshly slaked lime and a concentrated solution of borax. Let the lute get thoroughly dry.

No. 2.—Take powdered clay and brickdust, and mix it up with a solution of borax in water.

Crucible Cement.

This cement is used for joining crucibles which are exposed to a strong heat.

No. 1.—Mix powdered clay and brickdust with water, or a solution of borax. When the latter solution is used, the lute becomes a compact vitreous mass in the crucible.

No. 2.—Form a paste with 2 parts borax, 2 parts slaked lime, and 1 part of litharge and water.

This cement can also be used for china.

Earthenware, Glass, &c., Cement for.

1 part isinglass, 4 parts water, 4 parts acetic acid.

Steep the isinglass in water, and then dissolve it in the acid.

Electrical Apparatus, Cement for.

Melt 8 oz. beeswax and 2½ lb. resin, and stir in 8 oz. red ochre and 1 oz. plaster of Paris.

Electrical Cement.

The following preparation is known as Faraday's Cap Cement. It is used for fastening brasswork to glass tubes, flasks, &c.

5 oz. resin, 1 oz. beeswax, 1 oz. red ochre, or other red oxide of iron in powder.

Heat the red earth to a temperature of 212° F. on a plate in front of a fire, or over a gas flame, so as to expel inherent moisture; then, having melted the resin and wax together, stir in the powder by degrees. Stir until cold, lest the earthy matter settles to the bottom.

Entomologist's Cement.

No. 1.—Mix equal parts of isinglass and thick mastic varnish. The first can be softened in alcohol.

No. 2.—This cement melts at a gentle heat.

Dissolve gum ammoniac in alcohol, and add the best quality of isinglass, and mix by aid of a gentle heat.

Fat Cement.

No. 1.—Clay is dried, powdered, sifted, placed in an iron mortar, and incorporated with drying-oil added gradually, the whole being well beaten up till the mass assumes the consistence of a fine paste. It should be preserved under a coating of oil to prevent it drying up.

This cement resists the action of corrosive gases, but inconveniently softens by exposure to heat.

No. 2.—This cement stands a dull red heat. It consists of plaster of Paris mixed with water, milk, or weak glue.

Fat Lute.

Powder some clay, sift it, and put it in an iron mortar, and

then mix with it drying-oil, adding it gradually ; then beat up the whole until the mass assumes the consistence of a fine paste. It should be preserved under a coating of oil to prevent it drying up.

This lute resists the action of corrosive gases, but softens on exposure to heat.

Plaster of Paris mixed with water, milk, or weak glue stands a dull red heat.

Fireproof Cements.

No. 1.—14 parts iron filings, 2 parts hydraulic lime, 2½ parts quartz sand, ⅓ part sal ammoniac ; vinegar.

Make all into a paste with the vinegar, and then apply, allowing the cement to dry slowly before heating.

No. 2.—180 parts iron filings, 45 parts lime, 8 parts common salt; vinegar.

Mix all into a paste with the vinegar, and let it thoroughly dry before being heated.

This cement becomes stone hard on heating.

No. 3.—Linseed oil or almond meal mixed to a paste with milk, lime water, or starch paste resists a temperature of 500° F. (260° C.)

No. 4.—Clay is puddled with water, and to it is added the greatest possible quantity of sand, which has been passed through a hair sieve. The whole is worked up in the hands, and applied in coats more or less thick on vessels needing protection from the direct action of the fire.

No. 5.—1 part manganese peroxide sifted, 1 part zinc-white in fine powder. Silicate of soda, enough to form a thin paste, immediately, as it becomes very hard, and offers a complete resistance to red heat and boiling water.

No. 6.—As a coating for glass vessels to protect them from injury during exposure to fire, pipeclay and horsedung are made into a paste with water.

This composition is applied by spreading it on paper. It is used by pipemakers, and will stand the extreme heat of the furnace for twenty-four hours without damage.

No. 7.—Mix with linseed oil, to a paste, 20 parts fine river-sand, 2 parts litharge, and 1 part of quicklime. When applied to walls it becomes stony hard.

Gas Bags, Cement for.

Add glycerine to very thick boiled glue. Fill the bag with air, and apply while warm. If too sticky, strew it with a little powdered soapstone. For large rents, use leather well covered with glue.

Gelatine Cement for Microscopists' Use.

Soak ½ oz. of Nelson's gelatine in water; then melt in the usual way and stir in 3 drops of creosote, and put away in small bottle. Use it warm.

Glass Retorts, Cement for.

13¼ lb. iron filings, 2¼ lb. cement, 1 lb. plaster of Paris, 2⅓ oz. sal ammoniac, 1¾ oz. powdered sulphur, and 7 gills vinegar.

Mix all together, and stir into a paste with water.

This cement is not reliable if the article is exposed to moisture.

Glass Cement, Rutzon's.

5 parts Canada balsam, 5 parts shellac, 5 parts absolute alcohol, 10 parts anhydrous ether.

Mix the ingredients, and, when the solids are dissolved, filter, if necessary, and evaporate, away from the flame over a waterbath until of syrupy thickness.

Glue, Fireproof.

Mix a handful of quicklime in 4 oz. linseed oil; boil to a good thickness; then spread the compound on two plates, and place it in the shade. It will become very hard, but may be readily dissolved over the fire, and used as ordinary glue.

Glue for Repairing Glass.

Dissolve glue of the best kind in strong acetic acid to form a thin paste.

Glycerine Glue, for Enclosing Microscopic Preparations.

Place 1 part by weight of gelatine in a china vessel (as a cup, basin, &c.); pour on it 6 parts by weight of water, and allow to swell up during twenty-four hours. Then heat the mixture at 175° to 200° F. until it is entirely dissolved. Next add 7 parts of concentrated colourless glycerine, and well mix the two; then heat the mixture for ten or fifteen minutes, and, while warm, filter through cotton.

Grinder's Cement.

No. 1.—5 parts pitch, 1 part wood ashes, and 1 part hard tallow. Melt together.

No. 2.—4 parts black resin, 1 part beeswax, and 1 part whiting.

Melt the resin and wax, and, having heated the whiting red-hot, add that to the mixture while the whiting is still warm.

No. 3.—Shellac melted, and applied to the pieces slightly heated.

This is used to fix pieces of glass while grinding, and for lenses and fine work.

Guttapercha, Chatterton's Cement for.

2 parts resin, 2 parts Stockholm tar, and 4 parts guttapercha. Mix by heat.

Incandescent Lamp Filaments, Cement for.

Take 100 gr. carburet of iron (Dixon's Stove Polish) ground dry to a fine powder, add 10 gr. lump sugar, mix well in a mortar, then add 40 gr. gold bronze. Mix again, then add sufficient water to make a thick paste, and apply it to the junction between the carbon and the platinum wire; allow it to stand for twenty minutes or so; then burn the joint to a cherry-red heat by a fine gas flame.

Insects, Glue to Entrap.

1 lb. resin, $3\frac{1}{2}$ lb. molasses, $3\frac{1}{2}$ lb. linseed oil.

Mix all together and boil to a thick paste. Smear a thick stick with the mixture, and plant it in the ground, or in a flower-pot filled with sand.

Insulating Cement.

No. 1.—5 parts shellac, 2 parts resin, 1 part Venice turpentine, and 3 parts yellow ochre.

Dissolve the first three ingredients by heat, and stir in the ochre when the mixture is melted.

No. 2.—Common sealing-wax and jeweller's cement are very convenient for many uses.

Insulating Cement for Electrical Conductors.

Mix 66 parts by weight of finely powdered glass or quartz, and 34 parts by weight of pulverised vegetable or mineral resin,

and add 26 parts by weight of paraffin wax, beeswax, or spermaceti, and 3 parts by weight of boiled or raw linseed oil.

This preparation differs according to circumstances. If the mass is to be exposed to the sun, only a small quantity of the wax is to be used, while for underground lines the quantity of wax must be increased.

Insulating Cement, Flexible.

1 part by weight of mineral wax (paraffin oxycerite), 20 parts wood tar, 32 parts shellac, and 32 parts dry and finely powdered asbestos, flax cotton, wood, or paper, are mixed in a boiling at 100° to 200° F., and constantly stirred. For a harder mass use less tar. For an especially hard mass, omit the mineral wax, decrease the quantity of asbestos, and add about 24 parts of ground slate or clay free from iron.

Insulating Tapes, Cement for.

No. 1.—Pure gum rubber dissolved in turpentine, with the addition of 5 per cent. of raw linseed oil.

No. 2.—8 parts yellow wax, 2 parts beeswax, and 1 part tallow.

Melt all together by heat.

Insulators, Cement for.

Sulphur, lead, and plaster of Paris, with a little glue to prevent it settling quickly.

Iron Cement, Chenot's.

Made from iron reduced from the ores by hydrogen gas, and kneaded with gypsum or clay. A little vinegar is sometimes added to facilitate its hardening.

Iron and Blood Cement.

10 parts of pulverised lime with bullock's blood, 29 parts of cement, and ½ to 1 part of iron filings.

Mix the parts of lime with the cement and filings, and use at once.

Kitton's Whitelead Cement for Microscopic Use.

Equal parts of whitelead, redlead, and litharge (all in powder ground together with a little turpentine until thoroughly evaporated, then mixed with gold size. The mixture should be thin enough to work with a brush. No more of the cement

should be made than is required for present use, as it soon sets and becomes unworkable; but a stock of the material may be kept ready ground in a bottle.

Lenses, To Cement.

In foreign-made lenses occasionally an arborescent appearance is to be seen between the elementary parts of which it is cemented. To remedy this, inset the lens, place it in warm water, which may be still further heated till the balsam softens. Separate the components, and clean with either benzole or turpentine. Next place a drop of pure balsam on the centre of the concave surface and gently press the convex one down upon it until the balsam spreads and oozes out at the edges. Then apply a gentle heat until the balsam is found to have been hardened.

Lens-grinders' Use, Cement for.

No. 1.—Melt together 5 parts pitch, 1 part wood ashes, and 1 part hard tallow.

No. 2.—4 parts black resin, 1 part beeswax, and 10 parts heated whiting.

No. 3.—Use melted shellac.

No. 4.—Use resin and plaster of Paris.

No. 5.—Use Canada balsam to unite lenses.

Linzer's Cement for Electrical Machines, &c., Galvanic Troughs.

No. 1.—Melt together 5 lb. resin and 1 lb. of beeswax, and stir in 1 lb. red ochre, highly dried and still warm, with 4 oz. plaster of Paris, continuing the heat a little above 212° F., and stirring constantly till all frothing ceases.

Very useful in electroplating and electrotyping.

No. 2.—This cement is especially adapted for troughs, being used to cement the plates in voltaic troughs, and join chemical vessels.

6 lb. resin, 1 lb. red ochre (well dried), ½ lb. calcined plaster of Paris, and ¼ lb. linseed oil.

Prepare same as No. 1.

Lovett's Cement, Used by Microscopists.

2 parts whitelead finely powdered, 2 parts powdered redlead finely powdered, 3 parts litharge finely powdered gold size.

Mix the powdered materials together, and then take sufficient for use and make into the consistency of cream with gold size, and fasten the cells immediately to the slide. In two weeks they are secured. This cement stands a considerable heat, and is excellent for vessels holding fluids that contain some alcohol. As this cement hardens very rapidly, in which condition it is useless, make up to a paste only enough for use as wanted.

Microscope Cement.

This cement is useful for many purposes, and for many opaque objects for the microscope.

Put into a bottle 2 parts of isinglass and 1 part of gum arabic, cover this with proof spirit, cork the bottle loosely, and place it in a waterbath. and boil it until a thorough solution is effected, then strain it for use.

Microscopes, Guttapercha Cement for.

1 part guttapercha (cut in pieces), 15 parts turpentine, 1 part shellac.

Heat the guttapercha and turpentine together, filter, add the shellac (pulverised), and heat until a drop hardens on a cold glass plate. This cement is used to attach cells. The slide must be warm when using the cement.

Microscopic Objects, Paste for.

A thick fluid paste which dries quickly, does not crack, and adheres tenaciously to the glass, is required for fastening the glasses covering microscopic objects. A paste or cement prepared for solutions by dammar resin, asphaltum, or caoutchine, or a mixture of the two, but in very variable portions, is best adapted for the purpose. After the object to be pressed has been placed in the right position upon the glass, a ring of the paste is formed around it and the cover pressed down, and held there until the part has become hard. Benzine, petroleum, or bisulphide of carbon may be used as a solvent for dammar resin, caoutchine, or asphaltum. If the enclosure is to contain a fluid besides the microscopic preparation, it is best to prepare the paste from a mixture of caoutchine and asphaltum, as this resists fluids far better than a solution of dammar resin. The paste prepared from dammar resin has a yellow colour, that for caoutchine and asphaltum is black. A white paste is made

by rubbing Canada balsam with zinc-white and adding a sufficient quantity of benzine to give a syrupy consistency to the mass.

Minerals, Fossils, &c., Cements for.

No. 1.—Use best fresh glue (hot), and tie well.

No. 2.—1 part starch, 4 parts white sugar, 1 part gum arabic. Dissolve the gum in a little hot water, and boil all together until the starch is cooked.

Naturalist's Cement.

This cement consists of mucilage of gum arabic thickened with starch powder or farina, with the addition of a little lemon juice (to prevent decomposition). Sometimes the mucilage is used alone. Naturalists use this cement for mounting their specimens, while artificial-flower makers also use it for their purposes, and confectioners use it to stick ornaments on their cakes.

Necks of Bottles. Cements for.

Use boiled linseed oil or solid paraffin.

Prisms, Cement for Bisulphide of Carbon.

For bisulphide of carbon prisms, Mr. Lewis M. Rutherford, who has had much experience in this subject, employs a cement of glue and molasses. The surface must be perfectly clean. They are then warmed, and dusted with a fine camel-hair brush, and placed in contact. A hot and fluid mixture of glue and molasses is then applied round the edges, and penetrates by capillary attraction. It must be left a day or two to harden before preparing the next side. The ground stopper is also rendered light by a little molasses.

Marine glue is also employed, and we may suggest a trial of glycerine and litharge cement for this and other fluids put in the prism.

Retorts, Lutes for.

No. 1.—The following cement is used by the chemist Lemery for stopping retorts and receivers. It stops exceedingly close.

2 parts fine flour, 2 parts fine lime, 1 part potter's earth; white of egg.

Beat up the white of egg with an equal bulk of water, and make the solids into a moist paste with the fluid.

No. 2.—This cement is used also in melting pots.

Sift brickdust, and mix with an equal quantity of redlead. Rub the two together with boiled linseed oil, which should be mixed to the stiffness of cement with coarse sand.

In covering dishes, apply the paste, then dust the sand over it. Heat for a long time.

No. 3.—Rub freshly-slaked lime into a concentrated solution of borax; apply with a stiff brush, and allow it to dry. When heated, this cement fuses, and forms a glaze.

No. 4.—For large pots.

Take 3 parts litharge, 2 parts freshly-burnt pulverised lime, 1 part white bole; linseed oil.

Mix the whole with the oil.

Zinc Cement, Used by Microscopists.

Dissolve 1 oz. gum dammar in 1 oz. oil of turpentine by the aid of heat. Rub up 1 drm. zinc oxide with an equal quantity of oil of turpentine (adding the latter drop by drop) into a creamy mixture perfectly free from lumps or grit, and then mix the two fluids, which must be stirred well together and strained through fine muslin wetted with turpentine. Blue or a green pigment may be worked up with this if desired.

IV. CEMENTS FOR CHINA, GLASS, AND EARTHENWARE.

Bisque, Cement for.

Oystershells, white of eggs. Well wash oystershells, well burn them, and let them dry in the air; then finely powder them and sift the powder through a fine sieve; then mix into a paste with white of egg. Have the fractured surface well cleaned, apply the cement quickly after making it into a paste, and hold the joined parts tightly together for a couple of minutes after cementing them.

Botany Bay Cement for Coarse Earthenware.

This cement consists of equal parts of yellow gum and brick-dust melted together.

Bottger's Cement.

This cement is made by stirring finely precipitated chalk into a solution of sodium silicate at 33° B., to which pigments may be added if desired to give colour. The cement hardens in six to eight hours.

Bottger's Waterglass and Lime Cement.

100 parts whiting, 25 parts thick solution of waterglass.

This cement becomes so hard that in a few hours it can be polished. It is especially adapted for cementing the joints between marble and slate.

Bottle Cement.

4 parts resin, 1 part tallow or suet.

Melt together and stir in the required colouring matter, whiting, ochre, or ivory black; use hot.

Bottle, Cement for the Top of.

No. 1.—Mix gelatine and glycerine, and use warm by dipping the neck of the bottle in the mixture. Repeat if necessary.

No. 2.—Copal varnish, redlead.
Make into a thick varnish with the pigment.

Canada Balsam.

This article is used as a cement for uniting lenses. If it be too viscid it can be thinned with turpentine or benzole, but the latter fluid should not be used unless the balsam is very hard. A gentle heat is desirable in order to manipulate properly.

Caoutchouc Cement, for Glass.

No. 1.—1 part caoutchouc, 12 parts mastic, 4 parts dammar, 50 parts chloroform, 10 parts benzole.

Dissolve the solids in the mixed fluids, and apply the mixture to the edges of the glass to be joined. They adhere at once, and when dry a tenacious joint is made.

The following formula gives a transparent cement :—
2 parts caoutchouc, 6 parts mastic, 100 parts chloroform.

Digest the first two solids in the third ingredient by mixing altogether in a bottle and standing it in a cold place for a few days. Make only sufficient for immediate requirements as this cement must be used at once, for in a very short time it becomes viscid.

Caseine Cement.

Many cements for various purposes may be prepared from caseine. Pure caseine is the best to use, but that from old cheese may be used. This, however, always contains some fat, salt, and acids, which exert an injurious effect upon the hardness and solidity of the cement.

Pure Caseine, To Prepare.

Skim some fresh milk so that not a trace of cream remains. Then allow it to curdle by letting it stand in a warm place. Then collect the curdled milk on a filter paper, and wash the caseine by pouring soft water on it until the batter shows no trace of free acid. To remove the last trace of free acid, tie

the caseine in a cloth and boil it in water. Then spread it out upon clean new blotting paper, and let it dry gradually in a warm place, when it will shrivel up to a horn-like mass. This pure caseine when properly prepared can be kept for a long time without injury.

Cheese Cement, for Mending China.

Take skim-milk cheese, cut it in slices and boil it in water. Wash it in cold water, and knead it in warm water several times. Place it warm on a levigating stone, and knead it with quicklime. This cement will join marble, stone, or earthenware so that the joining is scarcely to be discovered.

China, Cement for.

Dissolve ½ oz. gum arabic in a wineglassful of boiling water, and add enough plaster of Paris to form a thick paste, and apply it with a brush to the parts required to be cemented together.

Two parts shellac, 1 part Venice turpentine, 1 part resin; fuse together and mould into sticks.

Crockery, Strong and Hard Cement for.

One part guttapercha, 1 part shellac.

Place the two ingredients in an earthenware jar or pipkin, and melt the two together by standing this jar on a vessel of boiling water, or else one filled with hot sand, the vessel holding the water or sand being heated over a fire or gas furnace. Then the ingredients are melted together and well stirred. The resulting cement is one possessing great hardness and toughness, which suits it admirably for mending crockery.

Warm the edges to be joined with the cement, smear that on, join together, and hold the articles thus joined until cool.

Earthenware, Cement for.

No. 1. *Coarse.*—Use yellow resin and brickdust melted together.

No. 2.—*Finer* for certain purposes, brimstone.

No. 3.—Use 2 parts of grated cheese, 1 part quicklime, and white of egg sufficient to form a paste.

No. 4.—Use white of egg, slightly diluted with water, and quicklime.

No. 5.—Use dried and ground milk curds, with 10 per cent. of powdered quicklime. Keep from the air, mix with water for use, and apply immediately.

Egg Cements.

These cements are handy, quick, and readily made in the household. Use white of egg beaten up with an equal quantity of water. (The omission of the water ensures failure in this recipe.) Then add enough slacked lime to make a paste, and use at once.

No. 2.—4 parts plaster of Paris, 1 part of lime, white of egg.

Freshly slack the lime, then reduce it to a fine powder, mix with enough white of egg to bring the mass to a workable consistence. Mix quickly, apply immediately, and allow it to remain undisturbed for at least three days.

If this cement be first dried in the air, and then over a fire, it will stand fire and water.

Elastic Cement.

Dissolve caoutchine in chloroform, with or without powdered quicklime.

Extemporaneous Cement.

No. 1.—Melt shellac and run it into sticks the size of a quill. This is used to join glass, earthenware, &c., by heating the edges sufficiently hot to melt the cement, which is then thinly smeared over them, and the joint made while they are still hot.

No. 2.—Mastic resin prepared in the same way is frequently used by jewellers.

German Cement, for Glass or Earthenware.

No. 1.—2 parts shellac, 1 part Venice turpentine. Put these together in an iron pot, and when wanted for use melt at a gentle heat. Care must be taken while fusing the material to keep the vessel closed, as the turpentine is very inflammable.

No. 2.—2 parts litharge, 1 part unslacked lime, 1 part flint

glass; pulverise separately and mix. To use this cement, moisten it with old drying oil.

Giant Cement, for Porcelain.

This popular cement goes under various names—such as *Diamond Cement*, *Unbreakable Cement*, &c.—and is sold in small bottles at 6d.

Isinglass, alcohol, strong, gum ammoniac powdered, rectified spirits of wine.

Soak 1 drm. of isinglass in water, and pour upon this enough alcohol to cover the mass, and allow the isinglass to dissolve, aiding the solution by placing the mixture in a warm place. Next dissolve ½ drm. of mastic in 1 fluid drm. of rectified spirits of wine. Mix both solutions together, then put into the mixture ½ drm. of powdered gum ammoniac, and evaporate the mixture in a waterbath until it has acquired the desired consistency. Put the cement in phials, and when it is wanted for use liquate the cement by standing the phial in a cup of hot water. Before use heat the edges of the articles where the joint is to be.

Glass, Cements for.

No. 1.—Mix 3 parts lead, 2 parts tin, 2½ parts bismuth.

No. 2.—This cement is, according to a German authority capable of resisting the solvent action of water.

From 5 to 10 parts of pure dry gelatine are dissolved in 100 parts of water. To the solution about 10 per cent. of a concentrated solution of bichromate of potash is added, and the liquid is kept in the dark. When articles joined by this cement are exposed to the light the gelatine film is acted upon by the chemical rays, the chromate being partially reduced, and the film of cement becomes tough and durable.

No. 3.—2 parts isinglass, 1 part mastic, 3 parts alcohol, 1 part gum ammoniac.

Well soak the isinglass in water, then pour off the water and dissolve the isinglass in alcohol by the aid of heat. Then dissolve the mastic in the 3 parts of alcohol. Then mix the two solutions and add the gum ammoniac. Well shake the solution and evaporate to the consistency of glue, when the cement solidifies on cooling.

For use, warm both the cement and the article.

No. 4.—Mix 5 parts of pumice-stone and 2 of shellac with 1 of turpentine.

No. 5. *Glass and China, Cement for, in Sticks.*—6 parts sulphur, 4 parts Burgundy pitch, 1 part shellac, 2 parts elemi resin, 2 parts mastic resin, 6 parts powdered kaolin, ground through a very fine sieve.

Melt all the ingredients together and heat the surface to be joined before applying the cement.

No. 6.—3 parts lead, 2 parts tin, 2½ parts bismuth.

No. 7.—Put the best and purest gum arabic into a small quantity of water and let it dissolve until it is of the consistency of treacle, then add calomel (mercurious chloride, a dead poison) to make a sticky mass, and well mix on a glass plate with a spatula. Do not make more than is required for immediate use. The cement hardens in a few hours

No. 8. *Transparent Cement for Glass.*—1 part indiarubber, 64 parts chloroform, 14 to 24 parts mastic in powder.

Dissolve the indiarubber in the chloroform, then add the powdered mastic, and let the mixture digest for two days with frequent shaking. Apply this cement with a camel-hair brush.

No. 9.—Take 1 oz. of Russian isinglass, cut it in small pieces, and bruise it well in order to separate the fibres; then add 6 oz. of warm water, and leave it in a warm place that the isinglass may dissolve, which will require from thirty-four to forty hours. Evaporate this to about 3 oz. Next dissolve ½ oz. mastic in 4 oz. of alcohol, and, when this is ready, transfer the isinglass from the evaporating dish to a tin can, heat both solutions, and add the mastic solution to the isinglass in small quantities at a time, shaking the can violently after each addition. While still hot strain the liquid through muslin cloth and put up in ½-oz. bottles.

This cement is very valuable, and articles, such as mortars, graduated measures, &c., that have been mended by it have been in use for years, and, in fact, seem to be stronger than they were originally.

No. 10.—1 part of caseine, 6 or 7 parts of sodic silicate.

Dissolve the caseine in the soluble glass. Apply it at once, and dry in the air.

No. 11.—Use bleached shellac and turpentine in varying proportions.

Bleached shellac, unless used freshly bleached, is very difficult to dissolve in turpentine or alcohol.

No. 12.—Melt together 1 part elemi, 4 parts shellac, 2 parts turpentine.

No. 13.—Use Canada balsam alone, or slightly diluted with turpentine.

No. 14. *Lime and Oil Cement for Glass.*—4 parts quicklime, 6 parts litharge, 1 part linseed oil varnish.

No. 15. *Oil Cement for Glass.*—10 parts burned lime, 15 parts litharge, 5 parts pipeclay, 3 parts linseed oil varnish.

No. 16.—When isinglass is boiled in water to a creamy consistence and a little alcohol added, it may be used warm on the cold articles (that is, they do not need heating).

No. 17.—With a small camel-hair brush rub the fractured edges with a little carriage-oil varnish, and, if neatly put together, the fracture will hardly be perceptible, and when thoroughly dry will stand both fire and water.

No. 18.—Dissolve fine glue in strong acetic acid to form a thin paste.

No. 19.—Use Canada balsam or gelatine which has been swelled in a solution of bichromate of potash. The bottle soon loses its yellow look and becomes unaffected by damp when exposed to moisture.

No. 20.—Melt and work together until mixed 2 parts of common black pitch and 1 part of guttapercha, or else 2 parts shellac and 1 part of Venice turpentine, melted together.

These cements are used warm. They are both unaffected by atmospheric influences.

No. 21.—Dissolve 1 oz. gum mastic in alcohol, soak 1 oz. of isinglass in water, add alcohol to dissolve it to a strong glue, and add ¼ oz. of sal ammoniac. Put the two solutions into a pipkin, heat and stir; put in a stoppered phial, and warm in a waterbath when about to use it. See also *Giant Cement* (p. 42).

No. 22.—1 part glue powdered very fine, 2 parts fluorspar, also very finely powdered, and 6 parts soluble silicate of soda.

To obtain the ingredients in the finest possible condition, shake each separately with water, allow the coarser particles to

deposit and then pour off the remainder which holds the finest particles in suspension.

Make the mixture very rapidly, quickly stirring, and when thoroughly mixed apply at once.

No. 23.—Take equal parts redlead (minium) and boracic acid, add ⅔ part fine white sand. Mix and grind to very fine powder, make into a paste with dilute sodium silicate. Apply as an ordinary cement, and heat light enough to fuse the water-glass.

Glass on Brass, Cement for Fastening.

3 parts resin, 1 part caustic soda, 5 parts water, plaster of Paris.

Boil the resin, caustic soda, and water together, when a resin soap forms. Collect this and mix it with half of its weight of plaster of Paris.

Glass on Iron, Cement for Fastening.

Soak fine white glue or gelatine in water over-night. Pour off the surplus water and add molasses equal to about 25 per cent. of the bulk of glue. Heat gently, and stir until the mixture is formed. The proportion of molasses can be varied to suit. Glycerine may be used instead of molasses.

Glass Letters, To Fix.

A thick solution of marine glue in wood naphtha is a good cement for fixing glass letters. The glass must be chemically clean, and must be previously scrubbed with soda, then with whiting and water, followed by the rough rubbing.

Glass on Metal, Cement for Fastening.

No. 1.—One of the best cements for uniting glass to other substances consists of a mixture of gum arabic and calomei. Its adhesive power is something marvellous. It is prepared as directed for No. 7, *Cements for Glass* (p. 42).

Although this cement hardens in a few hours, it is best to leave it to itself for a day or two. To ensure success it is necessary to use only the very best gum; inferior sorts are absolutely useless.

No. 2.—A cement for such purposes as fixing metal letters to glass windows consists of 15 parts of copal varnish, 5 parts

drying oil, 3 parts turpentine, 2 parts oil of turpentine, 5 parts liquefied marine glue, 10 parts slaked lime.

Melt in a waterbath, and add the lime to the melted mass.

No. 3.—This cement is for a similar use as No. 2.

Mix just before about to use this cement 2 parts litharge, 1 part whitelead, 3 parts boiled linseed oil, 1 part copal resin.

This cement is very secure and quick drying.

No. 4.—Dissolve 16 oz. of shellac in 1 pint of strong methylated spirit, and add to the mixture $\frac{1}{10}$th part of a solution of indiarubber in carbon bisulphide.

No. 5.—2 oz. glue solution (thick), 1 oz. linseed oil varnish (or $\frac{3}{4}$ of Venice turpentine).

Boil together and agitate until the mixture becomes as intimate as possible.

The cemented articles should be clamped together for a space of forty to sixty hours.

No. 6.—6 parts starch, 10 parts finely pulverised chalk, 3 parts Venice turpentine, water, alcohol.

Make the starch and chalk into a mixture with equal parts of water and spirit and the addition of the Venice turpentine, taking care to agitate the mass with a stick, so as to ensure its homogeneity.

No. 7.—4 parts glue, melted with the least possible quantity of water and 1 part Venice turpentine. Will resist moisture.

No. 8.—Rough the edges of the glass, and cement them with a creamy paste of plaster of Paris and alum water.

Make a saturated solution of alum and then add the plaster until you have a thick creamy mass. Put this into glass, and then insert the glass stem or rod of the article to be joined together and let it remain until quite hard.

No. 9.—2 parts litharge, 1 part whitelead.

Work into a pasty condition by using 3 parts boiled linseed oil and 1 part copal varnish.

Glass on Wood, Glue for Fixing.

Ordinary glue, wood ashes.

Render the glue fluid by raising it to the boiling point, and then stir in a sufficient quantity of finely-sifted wood ashes to form a mass of the consistency of syrup.

Use this cement while hot. This cement adheres well, is waterproof, and can be used for joining stone and wood.

Glassware, Cement for.

No. 1.—Delicate glassware as Venetian glass. Use best fish glue applied hot and afterwards tied well together.

No. 2.—Mix 5 parts of gelatine with 1 part of acid chromate of lime in solution.

This cement hardens by the action of light.

Metallic Letters on Plate-glass, to Cement.

Melt together. Mix 16 parts copal varnish, 6 parts drying oil, 3 parts Venice turpentine, 3 parts oil of turpentine, 5 parts liquefied glue, and add 10 parts quicklime in powder.

Parian Cement.

This well-known cement is made in a similar manner to Reeve's, but with the use of a solution of borax (biborate of soda) in place of alum. All these cements are capable of receiving a high degree of polish; and as they dry very rapidly can be painted over in a few days.

Porcelain, Cement for.

No. 1.—This is suitable for large articles.

Add plaster of Paris to a strong solution of alum till the mixture is of the consistency of cream. It sets readily, and is claimed to unite glass, metal, china, &c., quite firmly.

No. 2.—Use thick whitelead paint.

No. 3.—Coagulate milk with acetic acid, and well wash the caseine thus formed with water, and then dissolve it in a cold saturated solution of borax. A clear solution is thus obtained which is superior to gum arabic. For porcelain, mix this caseine with finely powdered quicklime. Apply it to the joint immediately, bind the article with cord and expose it to a gentle heat.

No. 4.—Into a clear solution of gum arabic stir plaster of Paris. Use immediately. Water, however, will destroy the joint made by this cement.

No. 5.—Mix 8 parts of yellow gum with 8½ parts of brick-dust in fine powder.

No. 6.—Mix china clay with asbestos, using no more water than is absolutely necessary to form a paste, and beat up the mixture well before using the cement.

This cement is more suited for a luting purpose than for cements; it will stand a high heat.

No. 7.—Stir the white of an egg into a stiff solution of glue.

Porcelain Letters, Cement for Attaching.

8 parts starch, 10 parts chalk (finely powdered), equal parts of alcohol and water, 3 parts of Venice turpentine.

Mix the starch and chalk to a paste with the spirit and water, and then mix in the Venice turpentine.

Quicklime and White of Egg Cement.

This well-known preparation has already been referred to. The compound is prepared by diluting white of egg with water (this is the secret of this cement successfully accomplishing its purpose; attempts fail to ensure success if the white of egg be mixed with the dry lime only) of an equal bulk, and beating this up with powdered quicklime to a thin paste. (See *Egg Cements*, p. 41.)

This cement should be used directly it is prepared.

Waterglass Cement, for Glass and Porcelain.

10 parts elutriated glass powder, 20 parts elutriated powder of fluorspar, 60 parts solution of waterglass.

Mix all together very quickly, and apply immediately. In a few days the cement is so hard that the cemented article can be polished.

Waterglass and Caseine Cement, for Glass and China.

10 parts caseine, 60 parts solution of waterglass.

Mix, and apply as soon as possible, and dry the articles in the air.

Waterglass and Lime Cement.

This cement is used for flag pavements by mixing with sharp-edged stones and stamping in moulds. It hardens slowly.

20 parts solution of waterglass, 8 parts quicklime, 80 parts whiting.

Mix the solid ingredients in the waterglass.

Waterglass, Zinc, and Pyrolusite Cement.

80 parts pyrolusite, 100 parts zinc-white, 20 parts water glass.

Mix quickly, and apply at once.

This cement hardens in a short time, and is especially adapted for cementing the joints of pipes exposed to a red heat, as, when once fused, it forms a glass-like mass of great adhesive power, and makes a very close joint.

Waterproof and Fireproof Cement.

This cement is available for metal, china, or earthenware.

Take 7 gills of sweet milk, and curdle by adding some white (*i.e.* acetic acid) vinegar, separate the whey from the curd, and into the whey stir the white of 4 or 5 eggs; then add finely powdered quicklime, and thoroughly mix the mass with a spatula.

Whitelead Cement, to withstand Heat.

Pure whitelead or zinc-white ground in oil and used very thick is an excellent cement for mending broken crockeryware, but it takes a very long time to harden. It is well to put the mended article in some storeroom and leave it there undisturbed for weeks, or even months. It will be then firmly united, and will not easily break again in the same place.

V. CEMENTS AND GLUES FOR THE LEATHER-WORKING TRADES.

Bootmakers' Elastic Guttapercha Cement.

No. 1.—1 part guttapercha, 10 parts benzine, 10 parts linseed oil varnish.

Dissolve the guttapercha in the benzine, and, when it is all dissolved, pour the clear fluid into another bottle containing the linseed oil varnish, and well shake the two together.

The bottle containing the benzine should be well corked or stoppered, as this fluid is very volatile, and also its vapour is inflammable.

This cement is especially applicable for attaching the soles of boots and shoes, as, on account of its great elasticity, it is not liable to break or crack when bent. To make it adhere tightly the surface of the leather is slightly roughened.

No. 2.—1 part pitch, 1 part guttapercha, 2 parts linseed oil that has been boiled with 5 parts of litharge.

Melt the guttapercha and pitch together, then add the oil, and continue the heating until the ingredients are uniformly commingled. Use this cement warm.

No. 3.—10 parts guttapercha, 10 parts black pitch, 1½ part oil of turpentine.

Melt the first two ingredients together, and then mix the oil of turpentine therewith, and use the cement hot.

No. 4.—100 parts guttapercha, 80 parts Venice turpentine, 8 parts shellac, 2 parts pure unvulcanised rubber, 10 parts liquid storax.

Heat the turpentine, then add the guttapercha and shellac, and, for use, melt the cement by the heat of a waterbath.

Elastic Cement.

No. 1.—4 oz. bisulphide of carbon, 1 oz. fine indiarubber, 2 drm. of isinglass, ½ oz. guttapercha.

Dissolve the solids in the fluid.

This cement is used for cementing leather and rubber, and when to be used the leather is roughened and a thin coat of the cement applied and allowed to dry completely; then the two surfaces to be joined are warmed and placed together, and allowed to dry.

No. 2.— 5 parts caoutchine, 3 parts chloroform, 1 part mastic resin.

Dissolve the first two together and then add the resin in powder.

This cement is elastic and transparent.

No. 3.—4 parts gutta-percha, 1 part pure rubber, 1 part pitch, ¼ part shellac, ½ part linseed oil.

Melt by heat and apply hot.

Elastic Glue.

Dissolve good common glue in water in the waterbath and evaporate the water down to a mass of thick consistence, to which add a quantity of glue equal in weight to the glue first taken, and continue heating the mixture until all the water has been driven off; then pour the mass into moulds, or on a marble slab. This mixture answers for stamps, printers, galvanic plasters, copies, &c.

Glue thus prepared will not spoil by keeping.

Glue for Fancy Articles, Fine Leather Goods, &c.

1 pint of rye whisky, 1 pint water, 4½ oz. powdered starch, 1¼ oz. good glue, 1¼ oz. Venice turpentine.

Mix the whisky and water together, then stir in the starch to make a thick paste. Separately dissolve the glue in an equal weight of water, and mix the Venice turpentine therewith. Mix thoroughly, and then compound this mixture with the starch paste by constantly stirring until all is well evaporated.

Guttapercha, Cement for.

1 part tar, 1 part resin, 3 parts guttapercha.

Melt together by heat.

Guttapercha Cement.

No. 1.—2 parts common pitch, 1 part guttapercha.

Melt the two bodies together in an iron pot, stir them well so as to insure thorough incorporation, then pour the liquid into cold water. When cold it is black, solid, and elastic, but it softens with heat, and at 100° F. is a thin fluid. This cement may be used as a soft paste or in the liquid state, and answers well for cementing metal, glass, porcelain, ivory, &c. It may be used instead of putty for glazing windows.

No. 2.—This cement is similar to No. 1, but using the ingredients in equal parts by weight.

Guttapercha Cement for Glass.

100 parts guttapercha, 100 parts black pitch or asphalt, 15 parts oil of turpentine.

Dissolve the solids in the turpentine, and use hot. Besides being useful for glass, this cement is well suited for every purpose, but adheres particularly well to leather.

Guttapercha Cement for Leather.

Guttapercha, bisulphide of carbon, petroleum.

Dissolve sufficient guttapercha in the fluid to form a mixture of the consistency of syrup; then dilute it with petroleum to the required limpidity, and put a thin layer of this cement on the leather, and press it tightly on the material to which the leather is required to adhere.

Guttapercha Cement for Leather Driving-belts.

10 parts bisulphide of carbon, 1 part oil of turpentine, guttapercha.

Dissolve sufficient guttapercha in the mixed fluids to form a paste.

Remove any grease there may be on the leather by laying a piece of rag on the leather and then running a hot iron over the rag so as to absorb the grease. Then roughen the two pieces of leather and spread a thin layer of the cement on each surface. Then join the two pieces and let them remain under a slight pressure until dry.

Guttapercha Solution for Shoemakers.

Guttapercha waste, cut up small, coal tar oil.

Soak the guttapercha in boiling water until it is soft, then

put the small pieces, which may be cut before or after softening, in a jar, and cover with coal-tar oil. Lightly bung up or cover the mouth of the jar to prevent evaporation of the oil, and allow the guttapercha to digest for twenty-four hours. Finally, melt the guttapercha in the coal-tar oil by standing the jar in a vessel of boiling water till perfectly fluid, frequently stirring the mixture.

To use this solution, warm it as above, so as to enable it to be easily applied. This is useful for putting on patches of leather on boots and shoes.

Hagar's Cement.

10 parts graphite (elutriated), 3 parts whiting, 3 parts litharge, linseed oil varnish.

Mix the three solids with the linseed oil varnish to form a stiff putty.

Indiarubber, Cement for Uniting.

Dissolve in bisulphide of carbon 10 parts of finely-chopped rubber, 1½ part of resin, and 1 part of shellac.

Leather, Cement for.

No. 1.—A good cement is guttapercha dissolved in bisulphide of carbon until it is of the thickness of molasses.

The parts to be cemented must be thinned down, then pour a small quantity of the cement on the part to be cemented, spreading it well so as to fill the pores of the leather. Warm the parts over a source of heat for about half a minute, apply them quickly together, and press hard. The bottle containing the cement should be tightly corked and kept in a cool place.

No. 2.—10 parts oil of turpentine, 10 parts of bisulphide of carbon, guttapercha.

Mix the turpentine and carbon bisulphide together, and then digest therein sufficient guttapercha to make a tough, thick, floury liquid.

Thoroughly free the leather surfaces from all grease, then apply the cement hot to both surfaces to be joined, bring them in contact and apply pressure until the joint is dry.

No. 3.—16 parts guttapercha, 4 parts indiarubber, 2 parts yellow pitch, 1 part shellac, 2 parts linseed oil.

Melt all together in the oil.

Leather Belting, Cement for.

Take equal parts of common glue and American isinglass, put them in a saucepan, cover them with water, let soak for ten hours, and then boil up the whole and add pure tannin (tannic acid) until the whole becomes ropey or appears like the white of eggs.

Apply this white compound warm. Buff the grain of the leather where it is to be cemented, rub the joined surfaces solidly together; let it dry a few hours, and it is ready for practical use.

This cement, if properly applied, is so effective that the belting will not need riveting.

Leather on Iron, Glue for Fastening.

Take the best glue, soak it in cold water till soft, then dissolve it in vinegar with a moderate heat, then add one-third of the bulk of white-pine turpentine. Thoroughly mix, and by means of the vinegar make it of the proper consistency to be spread with a brush.

To fasten leather to iron, paint the iron with some kind of lead colour, say whitelead and lampblack. When dry cover with the glue; while hot draw the leather on quickly, and press it tightly in places. If it be a pulley draw the leather round tightly, lap, and clamp.

Leather on Metal, Cement for Fastening.

No. 1.—Melt together equal parts of asphalt and gutta-percha, and apply hot under a press.

No. 2.—Digest 1 part of crushed nutgalls with 8 parts of distilled water for six hours, and strain. Macerate the glue with its own weight of water for twenty-four hours, and dissolve. Spread the warm infusion of galls on the leather, and the glue on the roughened metallic surfaces, apply the prepared surfaces together, and dry gently; the leather then adheres so firmly to the metal that it cannot be removed without tearing.

No. 3.—Soak the leather in a hot infusion of nutgalls, coat the metal with gelatine, and bring them together.

Leather on Pasteboard, Cement for Fastening.

50 parts strong glue, turpentine, water, and starch paste.

Dissolve the glue with a little turpentine with a sufficiency of water over a gentle fire, and to the mixture add a thick paste made with 100 parts of starch.

Apply this cement to the cardboard when cold. It dries rapidly.

Leather on Top Rollers, Cement to Fasten.

1 part gum arabic, 1 part isinglass. Dissolve each ingredient separately in water, and mix.

Leather and Cloth, Cement for.

3 parts guttapercha, 1 part caoutchine digested in 8 parts of bisulphide of carbon.

Rubber Cement for Leather Patches and Rubber Soles.

Cut up virgin or native indiarubber into small pieces, or else shred it, and put the rubber into a bottle to about one-tenth of its capacity; then put in benzine until about three parts full, but be certain that the benzine is free from oil. Then let the bottle stand undisturbed until thoroughly dissolved, and of a thick consistency. If it turns out too thick or thin add suitable quantities of either material to make of required consistency.

Rubber Cement for Rubber Boots and Shoes.

No. 1*a*.—1 part caoutchouc, 28 parts chloroform. Digest the caoutchouc in the chloroform.

No. 1*b*.—10 parts caoutchouc, 4 parts resin, and gum turpentine 40 parts.

To prepare this solution the caoutchouc is shaved into small pieces and melted up with the resin, the turpentine is ther added, and all is then dissolved in oil of turpentine. The two solutions, *a* and *b*, are then mixed together.

To repair a shoe with this cement first wash the sole over with it, then a piece of linen is dipped in it and placed over the hole; as soon as the linen adheres to the sole, the cement is then applied as thickly as required.

No. 2.—Digest caoutchouc in small pieces in about four volumes of naphtha, or carbon bisulphide, in a well-corked bottle for several days.

No. 3.—15 gr. of indiarubber, 2 oz. of chloroform, 4 drm. of mastic resin. First dissolve the indiarubber in the chloro-

form, and then add the mastic in powder. Allow the mixture to stand a week or two before using.

No. 4.—Dissolve 1 drm. of guttapercha in 1 oz. of bisulphide of carbon; filter through coarse filter-paper, add 15 gr. of pure rubber, rub the whole smooth with palette-knife, taking care to do it quickly. If necessary, thin with bisulphide of carbon.

No. 5.—Make a solution of 2½ parts of indiarubber in 70 parts of chloroform by slow digestion, and separately make a second solution by melting 2½ parts of indiarubber with 1 part of resin; add ½ part Venice turpentine, and lastly 10 parts oil of turpentine; mix the two solutions.

Shoemakers' Cement.

Dissolve guttapercha in chloroform to the consistency of honey. Heat the surface to which it is to be applied, and press together.

VI. CEMENTS FOR METAL-WORKERS' USE.

Armenian or Jewellers' Cement.

No. 1.—Dissolve 5 or 6 bits of mastic resin the size of a large pea in as much spirits of wine as will suffice to render it liquid; in a separate vessel dissolve as much isinglass (previously softened in water, though none of the water must be used) in rum or other spirits as will make a 2-oz. phial of very strong glue, adding 2 small pieces of gum ammoniac, which must be rubbed or ground until they are dissolved; then mix the above with a sufficient heat. Keep it in a closely stoppered phial, and when it is to be used set the phial in water.

This cement will unite even glass to polished steel, and unites almost all substances.

No. 2.—1 part thick isinglass glue, 1 part thick mastic varnish.

Melt the glue, and mix with the varnish, and keep well corked. Heat in hot water when wanted for use.

No. 3.—Isinglass, ½ oz. alcohol, 15 gr. pale gum ammoniac (in tears), 9 large tears gum mastic.

Steep isinglass in the alcohol until a thick mixture results, then add the gum ammoniac, having dissolved the mastic in as little alcohol as possible. Mix all together; keep the bottle closely stoppered. Dries colourless.

No. 4.—*Keller's Armenian Cement.*—½ oz. isinglass, 4 oz. water, 4 oz. alcohol, ¼ oz. best mastic, 1 drm. powdered gum ammoniac.

Soak the isinglass in the water for twenty-four hours, and then evaporate at the heat of a waterbath until reduced one-

half in bulk (*i.e.* to 2 oz.), add 2 oz. of alcohol, and strain through linen; in the remainder of the alcohol dissolve the mastic resin and mix it with the first fluid while that is warm; then add the gum ammoniac, and triturate together until perfectly incorporated, avoiding as much as possible the loss of spirit by evaporation.

No. 5.—*Ure's Cement.*—1 part isinglass, 6 parts water, 1½ part rectified alcohol, ½ part milky emulsion of ammoniac, and 5 drm. (if the other ingredients have been reckoned in ounces) of tincture of mastic (*i.e.* mastic resin dissolved in spirits of wine).

Boil the isinglass in the water until reduced one-half, then add the alcohol, boil for a minute or two, strain, and while hot, first add the ammoniac emulsion, and then the tincture (*i.e.* varnish) of mastic.

No. 6.—Isinglass swelled in a little water and then dissolved in proof spirit, 3 oz.; bottoms of mastic varnish (which heat clear), 1½ oz. Mix well.

Armenian Glue.

600 parts isinglass, 6 parts gum ammoniac, 60 parts mastic resin.

Mix a little spirit of wine with water and allow the isinglass to swell in it. Separately dissolve the mastic resin and gum ammoniac in a similar quantity of spirits of wine, and then mix the two fluids together.

Black Cement for Metals.

1 part of blacksmith's ashes, 1 part of sharp sand, 2 parts of resin.

Keep the two pieces well together for two minutes after applying the cement, having the fractured surface quite clean.

Boiler Joints, Cement for.

No. 1.—10 parts whitelead ground in oil, 3 parts black oxide of manganese, 1 part litharge.

Reduce to a proper consistency and apply where needed.

No. 2.—6 parts dried clay in powder, 1 part iron filings, boiled linseed oil.

Make the two solids into a paste with the oil.

Brass on Glass, Cement for Fastening.

No. 1.—2 parts resin soap, 1 part plaster of Paris.
Melt the soap and pound the plaster of Paris into a dough.

No. 2.—Substitute oxide of zinc tor the plaster of Paris, or slaked lime, which causes the cement to harden more slowly.

No. 3.—16 parts copal varnish, 5 parts oil, 3 parts turpentine, 3 parts oil of turpentine, 5 parts liquid glue, 10 parts stucco.
Melt the glue in the oil, and then mix altogether, stirring the stucco in last.

Brass Joints, Cement for.

2 parts caoutchouc, 1 part guttapercha, 10 parts iron filings.
Melt by the addition of heat and mix thoroughly.

Brass Plate, Cement for Letters in.

Use shellac coloured with black, red, or other coloured pigments; or else use the best sealing-wax of the colour required; finish washing the cut-out portions of the metal with a solution of borax, and running the cement in hot and smoothing off as much as possible, and afterwards rubbing down with pumice-stone and polishing with chamois leather moistened with methylated spirits.

Brass Signboards, Cement for Filling.

Melt together in a clean iron pot 2 parts each of best asphaltum and guttapercha, stir well together, and then add 1 part of shellac in fine powder. This cement may be coloured by mixing it while hot with smalt (for blue), vermilion (for red), or any other pigment. For use, melt the compound and run it into the parts to be filled.

Brunswick Black and Gold Size.

Equal parts of Brunswick black and gold size with a very little Canada balsam.

Mix the black and gold size, and then stir in the balsam, rendered fluid by heat.

Caseine Cement for Metal.

No. 1.—18 parts washed quartz sand, 8 parts caseine, 10 parts slaked lime.

Mix.

No. 2.—Mix 5 parts of washed quartz sand, 4 parts caseine, 5 parts slaked lime with water.

Castings, Cement for Repairing Defects in.

1 part black pitch, 1 part resin, iron filings.

Melt the resin and pitch in a crucible, and then add sufficient iron filings to form a stiff mass, and allow the mixture to become cold.

Heat the defective place in the casting, put a piece of the cement over the defective part, and press it down with a hot iron.

Cast-iron Cisterns, Cement for.

No. 1.—1 part sal ammoniac, 100 parts clean iron borings, water sufficient to make a stiff paste.

Mix one day before required for use and well drive the cement into the joints with a stiff caulking tool, a little narrower than the space between the flanges. Give at least three days to set before filling the cistern with water.

This cement sets as hard as the metal itself, and may be used for vessels of large dimensions.

No. 2.—12 lb. iron filings, 2 oz. sal ammoniac, 1 oz. sulphur, water.

Mix into a paste with water.

No. 3.—7 to 8 lbs. iron borings, 2 oz. sal ammoniac, water.

Prepare as for No. 2.

This lute is perhaps the strongest, but when the work is wanted to dry in a hurry, the quantity of sal ammoniac must be slightly increased, and a very little sulphur must be added. This addition causes quicker setting but reduces the strength. The lutes are dependent upon the oxidation and consequent expansion of the mass; therefore, the less foreign matter they contain the better. They should be made up only as they are required, as they spoil rapidly when containing much sulphur; they may

become quite hot in a few hours, and combustion has been known to take place in them when left together in quantities for a night.

No. 4.—60 parts fine sifted iron filings, 2 parts powdered sal ammoniac, 1 part flower of sulphur, water.

Make into a paste with water and apply immediately.

This iron sets as hard as the iron it is intended to lute.

Cast-iron Joints, Cement for.

A permanent and durable joint can be made between rough cast-iron surfaces, by the use of asbestos mixed into sufficient whitelead to make a stiff putty. This will resist any amount of heat and is unaffected by steam or water.

Cast-iron Tanks, Cisterns, &c., Cement for Repairing.

5 parts brimstone, 2 parts blacklead, 2 parts sifted cast-iron filings.

Melt the ingredients together, taking care that the brimstone does not catch fire. Well heat the damaged place by laying a piece of red-hot iron upon it. The place should be dry before laying the red-hot iron upon it, otherwise the steam generated might prove harmful if given off in large amount. Melt the cement in a melting-ladle till it becomes soft, and then stop the damaged part with the cement.

Chuck Cement, To Remove.

To remove chuck cement from lathe-work, warm the object over a spirit lamp and tap lightly with a stiff brush; the wax will adhere to the bottles. If in a hurry, a few seconds' boiling in alcohol will remove the remainder of the wax.

Cloth on Iron Rolls, Glue for Fastening.

Melt glue in the usual way and then stir in pure tannin until the glue becomes ropey, and spread this on the cloth and metal.

Cloth on Polished Metal, Cement for Fastening.

Cloth can be cemented to polished iron shafts by first painting the shafts with a coat of best whitelead paint. After the paint has dried hard, coat with Russian glue dissolved in water acidulated with a little vinegar or acetic acid.

Copper, Cement for.

This cement is used to lay upon the rivets and lapping edges of copper sheets. Mix powdered quicklime and bullock's blood.

Copper, Cement for Welding.

Make a mixture of 358 parts of phosphate of sodium and 124 parts boracic acid. The powder is applied when the metal is at a dull red heat. It is then brought to a cherry red, and at once hammered.

As the metal is very apt to soften when exposed to a high degree of heat, a wooden hammer is recommended.

All carbonaceous matters must be carefully removed from the surfaces to be joined, as the success of the operation depends on the formation of a very fusible phosphate of copper, which would be reduced by carbon to the state of a phosphide. The phosphate of copper dissolves a thin film of oxide on the surface of the metal, keeping them clean and in a condition to weld.

Copper or Iron on Glass, Cement for Fixing.

Melt carpenter's glue in wine vinegar, add a little Venice turpentine and boil up for half a day over a slow fire.

Copper to Sandstone, Cement for Fastening.

3½ parts whitelead, 3 parts litharge, 3 parts bole, and 2 parts broken glass, 2 parts linseed oil varnish.

Rub up all the ingredients in the varnish.

Coppersmiths' Cement.

No. 1.—Mix powdered quicklime and bullock's blood, and use at once.

Cracked Ovens, Steam Boilers, &c., Cements for.

No. 1.—2 parts litharge, 1 part fine sand, 1 part slaked lime. Mix and keep dry. For use, mix into a paste with water.

No. 2.—Mix into a paste with water, iron borings, powdered earthenware, pipeclay, salt and water.

Crocus Cement.

Crocus (an oxide of iron) mixed with a little linseed oil makes a hard and useful cement.

Cutlers' Cements.

The following compounds are for fastening blades of table knives in their handles :—

No. 1.—4 parts resin, 1 part beeswax, 1 part plaster of Paris or brickdust.

Melt the resin and wax, and stir in the plaster or brickdust. Fill the hole in the handle with the cement, heat the tang of the blade, push it in the hole and remove the superfluous cement that flows out.

No. 2.—16 parts resin, 16 parts hot whiting, 1 part wax.

No. 3.—5 parts pitch, 1 part wood ashes, 1 part hard tallow Melt together.

Diamantkitt.

This German cement consists of 10 parts graphite, 3 parts litharge, 2 parts of milk of lime, 1 part of slacked lime, linseed oil.

Mix the solids with enough oil to make a firm paste.

Diamond Glue (of best quality).

This preparation is employed by jewellers for cementing gems to corals, and can also be used for fastening pastes upon white glass. Prolonged exposure to the action of water does not readily soften it. It adheres very tenaciously to glass or gems.

8 parts isinglass, 1 part gum ammonia, 1 part galbanum, 4 parts spirits of wine.

Swell the isinglass in a mixture of water and a small quantity of the spirit, dissolve the resin in the remainder of the spirit, and then mix both together. Soften the gum by heat sufficient to render it workable.

Emery on Wood, Cement to Fix.

Take equal parts of shellac, white resin, and carbolic acid in crystals.

Melt the shellac and resin, and then ádd the crystals of acid; the effect is surprising.

Enamelled Dial Plates, Cement for Mending.

Mix white wax in shreds with zinc-white, equal parts, and melt the mixture and allow it to cool.

For use, warm the dial plate slightly, and press the cold cement on to the defective places. Scrape the cemented parts with a knife, to give a lustrous surface. More wax softens and more zinc-white hardens this cement. Do not spoil the colour by heating at too hot a temperature.

Evans's Cement.

26 parts of cadmium, 74 parts of mercury.

Form an amalgam, and dissolve the amalgam in an excess of mercury, knead it thoroughly, and heat, if necessary, so that the cement is plastic.

Fibrous Material on Metal, Cement for Fastening.

Any fibrous material can be stuck to metal, whether iron or any other metal, by a mixture composed of good glue dissolved in hot vinegar, with one-third of its volume of white-pine pitch, also hot.

This composition gives a sure and certain result.

Gas Retorts, Cement for.

The following cement can be used for cementing earthenware gas retorts which have to withstand very high temperatures:—

5 parts powdered glass, 5 parts chamotte meal, and 1 part powdered borax.

Chamotte meal is obtained by pulverising broken pieces of gas retorts. This cement is a hard glass, which only melts at the highest temperatures—this closes the leaks in the retorts.

To render the iron retort-cover which closes the retort air-tight, a cement is used consisting of Schwerspach powder to which as much soluble glass (silicate of soda) has been mixed as to obtain a paste of sufficient strength.

Gasfitters' Cement.

No. 1.—4½ parts by weight of resin, 1 part of beeswax, 3 parts Venetian red.

Melt the resin and wax together, then stir in the red pigment, and pour the mixture into moulds made of oiled paper or iron.

No. 2.—Use resin and brickdust.

Hard Rubber to Metal, To Fasten.

Make a thin solution of glue, and gradually add pulverised wood ashes until you have a stiff varnish. Use this cement hot.

Holes or Scars in Castings, Cement for.

A useful cement for filling holes or covering scars may be made (according to one authority) of equal parts of gum arabic, plaster of Paris, and iron filings, and if a little finely pulverised fine glass be added to the mixture it will make it still harder.

This mixture forms a very hard cement that will resist the action of fire and water. It should be kept in a dry state and mixed with a little water when wanted for use.

Hot-water Cement.

Dissolve 1 oz. of sal ammoniac in hot water, and mix with 100 lb. iron borings.

The cement may not set so rapidly as if less iron were used, but with the ramming it will make a better joint.

Iron Articles in Stone, Cement for Fastening.

14 parts plaster of Paris, 2 parts iron filings.

Mix and stir into a paste with water, and use as soon as possible, as the cement dries quickly.

Iron, Cements for.

No. 1.—Mix equal parts of sifted zinc-white and peroxide of manganese with soluble glass sufficient to form a thin paste, and use the cement as soon as made.

No. 2.—10 parts cast-iron borings, 1 part redlead, ¼ part alum, 5 parts lime, ⅛ part sal ammoniac.

Dissolve the alum and sal ammoniac in a small quantity of hot water, and mix in the other ingredients.

No. 3.—8 parts clean iron filings, 1½ part sal ammoniac, 1 part flour of sulphur.

Mix, and keep stoppered ready for use.

No. 4.—In use take 1 part of the mixture, 12 parts of new filings, add a few drops of sulphuric acid, and fill the cracks or the joints which require it.

No. 5.—Mix boiled linseed oil, litharge, and red and white lead.

Apply on each side of a piece of flannel or paper, and lay the same between the two pieces before they are bolted together.

Iron Fire-joints and Flues, Cement for.

Use iron filings, sal ammoniac, and borax.

Iron Cement (unaffected by red-heat).

4 parts iron filings, 2 parts clay, 1 part fragment of a Hessian crucible (or a piece of firebrick).

Reduce all the ingredients to the size of rape-seed, and mix together, working the whole into a stiff paste with a saturated solution of salt.

Iron Cement for Steam-tight and Water-tight Joints.

112 parts cast-iron filings or borings, 1 part sal ammoniaç, 1 part sulphur, 4 parts whiting.

Mix small quantity with a little water just before using. For minute cracks the cement is laid on externally as a thin seam; for larger fissures it is driven in with an iron. The edges of the metal and cement are involved in one common mass of rust, which is impermeable to steam or water.

Iron and Glass, Cement for.

15 parts copal varnish, 5 parts drying oil, 5 parts turpentine, 2 parts oil of turpentine, 5 parts liquefied glue, 10 parts slaked lime.

Put all the ingredients except the last into a jar, and stand it in a vessel of boiling water or waterbath, and melt all together; then add the slacked lime.

Iron Pipes, Cements for Closing Joints of.

No. 1.—5 lb. coarsely powdered iron borings, 2 oz. powdered sal ammoniac, 1 oz. sulphur, water sufficient to moisten the mixture.

Mix all the solid ingredients, and then moisten them with water. The cement hardens rapidly, but if time can be allowed, it sets more firmly without the sulphur.

This cement must be used as soon as mixed, and rammed tightly into the joint.

No. 2.—2 oz. sal ammoniac, 1 oz. sublimed sulphur, 16 oz. cast-iron filings or turnings.

Mix all these in a mortar and keep the powder dry. When it is to be used, mix it into twenty times its weight of clean iron turnings or filings, and grind the whole in a mortar. Then wet it with water until it becomes of convenient consistence, when it is to be applied to the joint. After a time this cement becomes as hard and strong as any part of the metal.

Iron Pots and Pans, Cement for.

2 parts sulphur, 1 part graphite.

Hold the sulphur in an iron pot over the fire until it begins to melt, then add the graphite, and well stir the mass till thoroughly melted and combined. Then pour it out on an iron plate or smooth stone, and when cold break it up. Holes should be first filled up with a rivet and then cemented over.

Iron to Stone, To Cement.

No. 1.—Use plaster of Paris mixed with water, and add iron filings, 1 of iron to 6 of plaster.

No. 2.—Mix into a paste, with water, 3 parts of plaster of Paris with 1 oz. iron filings.

Iron Stoves, Cement for.

10 parts wood ashes, 10 parts clay, 4 parts burnt lime, water.

Mix all together to a stiff paste.

Iron to Wood, To Cement.

Iron may be fastened in wood by dropping in the recess, prepared in the latter, a small quantity of a strong solution of sal ammoniac. This causes the iron to rust, rendering it very difficult to extract.

Iron to Iron, Cement for Joining.

60 parts of cast-iron bore chips powdered, 2 parts sal ammoniac, 1 part flowers of sulphur.

Mix all together and stir into a stiff paste with water.

Use the cement while fresh.

Iron upon Iron, Stone upon Stone, Iron and Stone, Cement for.

Mix glycerine and litharge into a paste, and use at once as it hardens rapidly.

This cement is insoluble, and is not acted upon by strong winds.

Iron Railings, Bars, &c., Cement for.

Take equal parts of sulphur and whitelead, with about one-sixth of borax. Incorporate the three so as to form one homogeneous mass.

When going to apply it, wet it with strong sulphuric acid, and place a thin layer of it between the pieces of iron, which should then be pressed together. In five days it will be perfectly dry; all traces of the cement having vanished, and the iron will have the appearance of having been welded together.

Iron and Steel, Cement to prevent Rust in.

Add 7 gills of cold water to 7 oz. of quicklime. Let the mixture stand until the supernatant fluid is entirely clear. Then pour this off, and mix it with enough olive oil to form a thick cream, or rather to the consistency of melted and recongealed batter. Grease the articles of iron or steel with this compound, and then wrap them up in paper; or, if this cannot be done, apply the mixture somewhat thicker.

Jewellers, Cements for.

No. 1.—For uniting the pieces of a broken gem.

Warm the parts and place gum mastic between them. It will melt by the heat, and will be scarcely observable.

No. 2.—For temporarily holding a glass set in a piece of metal while being shaped and chased.

Resin 4 parts, wax ½ part, whiting 4 parts, mix and heat.

No. 3.--For ditto.

Take pitch, resin, a small quantity of tallow, and thicken with brickdust. Stir in a pipkin over a fire.

No. 4.—Isinglass, mastic resin, spirits of wine, benzine.

Dissolve the isinglass in as small a quantity of water as possible, adding a little spirit of wine to facilitate the operation. Separately prepare a mastic varnish of the resin by dissolving it in as small a quantity of the mixed fluids as possible; then take 1 part of this mastic varnish solution and mix it with 2 parts of the isinglass solution.

Jewellers' Turkish Cements.

No. 1.— 3 oz. isinglass, 1½ oz. best gum arabic, alcohol.

Put both ingredients in a bottle and pour in alcohol until it covers them, then cork up loosely and stand the bottle in a saucepan of water, and bring the water to a boil, and continue it at such heat until a thorough solution is made; then strain

This is a good cement.

No. 2.—50 parts isinglass, 25 parts mastic varnish, alcohol, benzine.

Digest the mastic in as little as possible of the mixture of alcohol and benzine (equal parts), and dissolve the isinglass in as little water as possible; then mix the two compounds, and mix thoroughly.

Knife-handles, Cement for Fixing.

4 parts black resin, 1 part beeswax, 1 part brickdust.

Melt the resin and wax together, and then stir in the brickdust to give a grip.

Labels on Iron, Glue to Fasten.

Make a paste of rye flour and glue and add ½ oz. linseed oil and ½ oz. turpentine to each pound of the paste.

Labels on Nickel, Cement for Sticking.

Dissolve 20 parts of dextrine in 25 parts of water, 1 part glycerine, and ½ part glucose, and heat the mixture.

Labels on Tin Plates, Cement for Sticking.

No. 1.—Mix a little honey or glycerine with ordinary paste

No. 2.—Add hydrochloric acid to the gum. This, however, is liable to cause the metal to rust under and around the label.

No. 3.—Add a little ammonia or tartaric acid to the starch paste or mucilage.

No. 4.—Add aluminium sulphate (not alum) to the mucilage.

No. 5.—The best plan is said to be to add 20 drops of a solution of chloride of antimony to 8 oz. of paste.

Metal, Linseed-oil Cement for.

Make a paste of linseed oil and well-slaked lime, and use great pressure to cause thorough adhesion.

Metal on Porcelain, Glass, &c., Cement for Fixing.

Dissolve good glue in water and add half as much linseed oil and varnish and a quarter as much Venice turpentine to the amount of glue used.

Metal Letters, Cements for Fastening.

No. 1.—3 parts copal varnish, 1 part linseed oil varnish, 1 part oil of turpentine, 1 part glue, 10 parts slaked lime.

Dissolve all these ingredients except the last together by plunging the vessel in a water bath, and when the solution is complete stir in the slaked lime.

No. 2.—15 parts of a varnish made by dissolving sandarac and white resin in alcohol, 5 parts linseed oil that has been boiled with litharge.

5 parts oil of turpentine, 5 parts marine glue, 10 parts flake-white, whitelead mixed.

Mix the varnish with the oil and then add the turpentine, and to the mixture add the marine glue; dissolve all together by the aid of a hot-water bath, and then add the lead whites.

No. 3.—15 parts copal varnish prepared with an addition of resin and 5 parts oil of turpentine, 2 parts powdered isinglass, 5 parts sifted iron filings, 10 parts washed clay or ochre.

Mix all together to a homogeneous mass.

No. 4.—15 parts copal varnish prepared with gum-lac, 5 parts linseed oil boiled with litharge, 8 parts solution of caoutchine in tar oil, 7 parts tar oil, 10 parts Roman cement and plaster of Paris.

Mix to a uniform mass.

No. 5.—This cement is used for fastening metal letters to plate-glass :—

15 parts copal varnish, 5 parts drying oil, 2 parts oil of turpentine, 5 parts liquefied glue made with the least possible quantity of water, 10 parts fresh slaked lime in fine powder and perfectly dry.

Melt all the ingredients except the last by the heat of a water bath, and then add the lime.

Metal Letters on Glass, Cements for Fixing.

No. 1.—3 parts copal varnish, 1 part linseed oil varnish, 1 part oil of turpentine, 1 part glue.

No. 2.—Mix Canada balsam with carpenter's glue 3 oz., and Venice turpentine ½ oz.

Metal Sheets (Thin), To Cement.

Dissolve isinglass cut fine in warm water and add a little nitric acid. If more acid is used than is necessary the cement will not dry.

Metallic Cements.

No. 1.—This cement is useful for attaching glass, metal, and china to wood, and in cases where soldering is not available.

Make 20 to 30 parts of finely divided copper into a paste with oil of vitriol (sulphuric acid) and add 70 parts of mercury, well rubbing the whole together. When the amalgamation is complete, remove all the acid by washing the pan with boiling water, and allow the compound to cool. In ten or twelve hours it becomes sufficiently hard to receive a brilliant polish and to scratch the surface of tin or gold. By heat it assumes the consistency of wax, and as it does not contract by cooling, it has been recommended for dentists' use in stopping teeth. To obtain the copper in a purely divided state, dissolve some blue vitriol (*i.e.* sulphate of copper) in water and then put in the mixture a strip of clean iron ; the copper will become deposited on the iron and should be scraped off and well washed for use. Or heat the cement to 212° F. and powder it in an iron mortar heated to 302° F. (151° C.). It then assumes the waxy consistency, and is harder in proportion as it contains more copper.

No. 2. *A Useful Cement for Repairing Broken Stone.**—It consists of a powder and a liquid.

To prepare the powder, mix and grind 2 parts by weight of oxide of zinc, 2 parts of crushed limestone of a hard nature, and 1 part of crushed grit, and add ochre in suitable proportions or a colouring matter.

To prepare the liquid, make a saturated solution of zinc in commercial hydrochloric acid and add thereto hydrochlorate of ammonia equal in weight to one-sixth that of the dissolved zinc, and dilute the mixture with two-thirds of its bulk of water. To use the liquid, mix 1 lb. of the powder with 2½ parts of the liquid.

This cement hardens very quickly and is very strong.

No. 3.—4 parts fish isinglass (in powder), 6 parts iron filings, 20 parts ochre or rottenstone.

Mix to a paste.

No. 4.—1 part caustic soda, 3 parts resin, 3 parts plaster, 5 parts water.

Boil all the ingredients. The resinate formed by the union of the caustic alkali and resin forms an agglutinant which holds the plaster well together. The compound as thus made hardens at the end of half an hour, but this hardening may be retarded by replacing the plaster by zinc-white, whitelead, or slaked lime.

No. 5.—2 parts fine litharge, 1 part whitelead, 1 part copal, 3 parts boiled linseed oil.

Rub the whole well together and dissolve by heat.

Metals on Non-metallic Surfaces, Cements for Fastening.

No. 1.—Wood ashes with thin-made glue to the consistence of thick varnish. Add the ashes gradually during the boiling of the glue, with constant stirring, and use the glue hot.

No. 2.—8⅓ oz. strong gum arabic solution, to which add a solution of 30 grm. sulphate of aluminium dissolved in two-thirds of water.

Oil Cement for Steam Pipes.

No. 1.— 8 parts heavy spar, baryta or barytes, 6 parts graphite, 3 parts lime slaked, 3 parts boiled linseed oil.

Make into a paste.

* This cement was used in the restoration of the colonnade of the Sonne, of the Pont Neuf, and of the Conservatoire des Arts, at Paris.

No. 2.—10 parts redlead, 25 parts whitelead, 20 parts pipe-clay, boiled oil.

Mix to a paste with the oil.

Opticians' Cements.

No. 1.—In fine work shellac softened with rectified spirit or wood naphtha.

No. 2.—1 part beeswax, 15 parts resin, 4 parts whiting.

Melt the wax and resin, and, having made the whiting hot, stir that in while still warm.

No. 3.—4 parts resin, 1 part plaster of Paris dry.

Melt the resin and stir in the plaster.

Nos. 2 and 3 are used to fix glasses, stones, etc., while polishing and cutting. A very strong cement for rough purposes.

No. 4.—10 parts resin, 2 parts shellac, 1 part rouge (*i.e.* colcotha, an iron oxide).

Melt the resin and shellac with the rouge, and then add enough turpentine to make the compound tough so as not to splinter under pressure from the thumbnail at the working temperatures of the room.

Pallock's Cement for Iron and Stone.

Take litharge and redlead equal parts.

Mix thoroughly and make into a paste with concentrated glycerine to the consistency of soft putty. Fill the cracks and smear a thin layer on both sides of the casting so as to completely cover the fracture. This layer can be rubbed off if necessary when nearly dry by an old knife or chisel. Mr. Pallock has used it to fasten the different parts of a fly-wheel with great success. This cement is fire and water proof.

Plumbers' Cement.

1 part black resin, 2 parts brickdust.

Well incorporate the two bodies by a melting heat.

Pots and Pans, Cement for.

2 parts of sulphur, 1 part fine blacklead.

Put the sulphur in an old iron pot, holding it over the fire until it begins to melt, then add the lead; stir well until all is mixed and melted, then pour out on an iron plate or smooth stone. When cool break into small pieces. A sufficient quan-

tity of this compound being placed upon the crack of the iron pot to be mended can be soldered by a hot iron in the same way as a tinsmith solders his sheets. If there is a small hole in the pot, drive a copper rivet in it and then solder it over with this cement.

Putty for Steam Joints in Iron Pipes, &c.

This putty is made by mixing 2 parts of a good metallic paint, 1 part of litharge, and 3 parts of fine iron borings in the dry state and mixing the whole to the consistency of stiff putty with linseed oil. To close joints iron filings are used instead of iron borings.

Putty for Stoves.

This preparation will set and harden with the heat of the stove.

5 parts clay, 2 parts fine iron filings, 1 part peroxide of manganese, ½ part salt (*i.e.* chloride of sodium), ½ part borax, water.

Pulverise all the ingredients and mix thoroughly together in a mortar; then make into a thick putty with water and use immediately.

Rubber on Metal, Cement for Fastening.

Shellac powdered, strong ammonia.

Digest the shellac in the ammonia in a bottle. This process will take several weeks. The mixture becomes transparent and glutinous. Weak ammonia will not answer. This fluid makes the rubber soft, but after the evaporation of the ammonia it becomes hard and impermeable to gases and fluids.

Rust Cements.

No. 1.—This cement is used for water and steam-pipes, steam-boilers, &c.

2 parts sal ammoniac, 35 parts iron borings, 1 part sulphur, water.

Mix into a stiff paste with the water and drive it into the joint with a chisel.

No. 2.—2 parts sal ammoniac, 1 part sulphur, 60 parts iron chips, and mix the whole with water to which ⅛ part vinegar or sulphuric acid is added.

No. 3.—100 parts of bright iron filings or fine chips or bor ings with 1 part pulverised sal ammoniac and moistening with water.

When thus prepared, force it into the joint.

This cement will prove serviceable under fire.

Steam Boilers, Cements for.

No. 1.—*Used to mend cracks and secure steam-joints.*

20 parts litharge finely powdered, 10 parts sand ground very fine, 10 parts quicklime slaked by exposure to the air only, *i.e.* not with water.

This mixture may be kept for any length of time without injury. When wanted for use, mix into a paste with linseed or boiled linseed oil; apply as soon as made, as it quickly becomes hard.

No. 2.—*Used for cracks and leaks in boilers, stoves, &c.*

6 parts clay dried and powdered, 1 part iron filings, boiled linseed oil.

Make into a paste with the oil.

No. 3.—Good linseed oil varnish ground with equal weights of whitelead, oxide of manganese, and pipeclay.

No. 4.—1 part clay dry and powdered, 2 parts clean sifted iron filings, acetic acid sufficient to make a paste.

Make into a paste with the acid.

No. 5.—8 to 10 parts clay, dried and powdered, 4 parts iron filings free from rust, 2 parts peroxide of manganese, 1 part sea-salt, 1 part borax, water.

Make all into a paste with water.

No. 6.—*This resists a very high temperature.*

1 part sulphate baryta, 2 parts clay, silicate of potash and borax solution.

Make into a paste with the solutions of potash and borax.

No. 7.—*Used for the joints of steam boilers.*

50 parts iron filings free from rust, 2 parts flower of sulphur, 1 part hydrochlorate of ammonia (powdered), water or urine.

Mix the solid components with either water or urine to make a solid homogeneous paste. The lute swells, becomes solid, and perfectly closes the joint.

No. 8.—*This cement becomes very hard on setting.*

4 parts iron filings, 2 parts loam, 1 part powdered sandstone salt water.

Make into a paste with the salt water.

No. 9.—This cement consists of a thick paste composed of silicate of soda and iron filings. The latter substance may be replaced by a mixture in equal parts of powdered oxide of zinc and peroxide of manganese.

No. 10.—84 parts sand, 166 parts Portland stone, 18 parts litharge, 0·90 parts pulverised glass, 0·45 parts redlead, 0·90 parts suboxide of lead, oil.

Rub up the solids with the oil.

No. 11.—*This cement is used to stop escapes of steam.*

16 parts iron boring, 2 parts sal ammoniac in powder, 1 part flower of sulphur, 21 parts fine iron borings, water.

Mix the first three ingredients thoroughly dry, and then for use, make into the consistence of mortar with water, adding the 20 parts of fine iron borings. Use this cement at once.

Steam Pipes, Cement for.

2 parts litharge, 1 part powdered slaked lime, 1 part sand.

Rub altogether as fine as possible and mix the mass with a sufficient quantity of hot linseed oil varnish to form a stiff paste. Use this cement while fresh and warm.

Steam or Gas Pipes, Cement for.

This cement is impermeable to air and steam. It is made by—

6 parts powdered graphite, 3 parts slaked lime, 8 parts sulphate of lime, 7 parts boiled oil.

Well knead all together.

Stereotyping, Paste for.

Take 5 oz. of flour, 7 oz. starch, a large tablespoonful of powdered alum, and 4 quarts water. Put the flour, starch, and alum into a saucepan and mix with a little of the water, cold, until the whole becomes of the consistency of thick cream; then gradually add the remainder of the water, which must be boiling, stirring well meanwhile to prevent lumps. Put the mixture over the fire and stir until it boils; then let it stand until quite cold, when it should look like jelly. When you are

ready for work, add Spanish whiting, the mixture not to be too stiff to spread readily with the paste brush. Put through a fine wire sieve with a soft stiff brush, and it is ready for use.

Stoves, Cements for Closing Cracks in.

No. 1.—This cement is prepared by mixing finely-divided iron, such as can be procured at the druggist's, with liquid water-glass (soluble silicate of soda) to a thick paste, and then coating the cracks with it. The hotter the fire then becomes, the more does the cement melt and combine with its metallic ingredients, and the more completely will the crack become closed.

No. 2.—Take equal parts of sulphur and whitelead with about ⅛ part of borax; incorporate them so as to form one homogeneous mass. When applying it, wet it with strong sulphuric acid and place a thin layer between the two pieces of iron, which should then be pressed together.

No. 3.—6 parts sand, 5 parts iron filings, 5 parts bone-black, 6 parts slaked lime, water.

Make into a paste.

No. 4.—Finely pulverised binoxide of manganese mixed with a strong solution of silicate of soda to form a thick paste. Fill the cracks and heat slowly.

No. 5.—Or else 1 in 4 parts of dry clay mixed with 1 part of a solution of borax.

No. 6.—This consists of mica, together with finely-sifted wood ashes, an equal quantity of finely-powdered clay, and a little salt. When required for use, add enough water to make into a stiff paste.

No. 7.—An excellent cement consists of glycerine and litharge stirred to a paste.

Temporary Cement.

A cement which may be used temporarily to fix optical glasses, stones, jewellery, &c., on sticks or handles for the purpose of painting, repairing, or ornamenting, is made by melting together at a good heat 2 oz. of resin, 1 drm. wax, and 2 oz. of whiting. With this applied to the article when heated it may be securely fixed, and it may be unfixed at pleasure by the same means, viz. heat.

Waterpipes, Silicate of Soda Cement for.

This cement stands an intense heat. It is made by mixing 10 parts of zinc-white and 8 parts of pyrolusite in 2 parts sodium silicate.

Waterproof Cement for Cast-iron Pipes, &c.

A cement somewhat similar to this, but varying in proportions, has already been given.

Take equal parts in weight, in dry powder, of burnt lime, Roman cement, pipeclay, and loam, and knead the whole with about one-sixth the weight of linseed oil. The addition of more Roman cement improves the quality.

VII. CEMENTS AND GLUES FOR WOOD-WORKERS' USE.

Abolithe Cement.

This new cement, for which is claimed excellent hardening qualities, is made by calcining magnesite (the carbonate of magnesia) in ovens similar to those used for gas making, after which it is pulverised and mixed with a quantity of fine silica.

The cement is declared to possess great hardness and durability. It adheres with much tenacity to wood, and its application as a preserver of timber—as railway sleepers and the like—by painting it upon the surface has been tried with success. It may be used also to replace the dilapidated stones of a building.

Ash Cement.

A mixture of glue and ashes made as below forms a cement that will cement wood to metal, glass, stone, &c., and so strong is the union that after cooling and drying the surfaces can only be separated with very great force. Grinding stones fastened on wood and handles to painters' stones for grinding colours have been used for twelve months without separating.

Warm up good cabinetmaker's glue to the consistency necessary to connect wooden objects, then add enough sifted ashes to bring the glue to the thickness of a varnish; warm the surfaces, and use the glue hot, then press closely the surfaces to be united.

Barrels and Casks, Cement for Closing.

No. 1.—5 parts tallow, 4 parts wax, 8 parts wood ashes sifted.

Melt altogether and apply hot.

No. 2.—5 parts tallow, 4 parts wax, 8 parts lard, 5 parts sifted wood ashes.

Melt the first three ingredients together and stir in it the ashes while hot, and apply the mixture to the leaky place by means of a hot knife-blade.

Beer Barrels, Cement for Inside of.

Glazing beer barrels, being cheaper and better than pitching, is adopted in many large breweries. To make such glaze or cement, dissolve 8 oz. resin, 2 oz. shellac; 1 oz. turpentine (solid), and ½ oz. yellow wax in 1 quart strong spirit of wine, and apply the solution twice to the inside of the barrel by means of a brush. As soon as the second coat is dry, apply another coat by dissolving 16 oz. shellac in 1 qt. strong spirit of wine. This varnish closes the pores, does not brush off, nor injure the taste of the beer.

No. 2.—Another cement for the same purpose is made by a solution of waterglass of 1·25, rubbed up with ⅛ of 1 per cent. of magnesia. This glaze is very cheap, and as it can only be dissolved by long-continued boiling in water, allows of a thorough cleansing of the barrels.

Brewers' Cement for Inside of Barrels.

No. 1.—8 parts resin, 2 parts shellac, 32 parts turpentine, ½ part yellow wax, about 42 parts strong alcohol.

Melt the wax and resin in the turpentine, the shellac in the alcohol, and mix all together.

This cement, or rather varnish, should be applied twice to the inside of the barrel, and after the complete drying of the second coat apply a third coat, consisting of 1 lb. of shellac dissolved in strong alcohol.

The cement will perfectly cover up the pores, and will not crack off or impart a foreign taste to the beer.

No. 2.—7 oz. shellac, 7 oz. dammar resin, 14 oz. colophony, 3 quarts spirits of wine.

Dissolve the solids in the spirits by the heat of a water bath.

If the compound is to be applied to barrels which have been glazed, it is advisable not to allow the new coating to dry, but to set the glaze on fire and quickly place the lid upon the barrel. The old coating will then melt together with the new into a uniform, very tightly-adhering mass.

Brewers' Pitch, for Cementing the Pores of Barrels.

No. 1. *Light Yellow Pitch.*—100 parts of pine pitch, 5 to 6 parts caustic soda, lye 10 per cent. B.

Melt the pitch in an open iron boiler, and then add the caustic soda, constantly stirring the mixture while adding it. When the mass in the boiler no longer rises and the formation of bubbles has ceased, pour the fatty pitch into iron moulds and allow to cool.

No. 2. *Brown Pitch.*—150 parts pure resin, 50 parts red transparent Armenian resin, 10 parts rectified heavy resin oil.

Melt the pitch and resin in an open iron boiler, then add the resin oil; stir well and pour into moulds until thoroughly incorporated.

No. 3. *Ordinary Brown Brewers' Pitch.*—3 parts fine pitch, 17½ parts brown resin, 1 part rectified heavy resin oil.

Prepare same as the last.

No. 4.—20 parts pine pitch, 17 parts red transparent resin, 2 parts rectified heavy resin oil.

No. 5.—15 parts pine pitch, 28 parts red transparent resin, 2½ parts rectified heavy resin oil.

No. 6.—4 parts pine pitch, 16 parts brown resin, 1 part rectified heavy resin oil.

All these are prepared as No. 1.

Casks and Cisterns, Air-tight and Water-tight Cement for

10 parts glue, 5 parts linseed oil, litharge.

Melt the glue in the oil, and then boil the whole into a varnish with litharge.

Dammar Cement for Inside of Barrels.

This varnish is very excellent for cementing or stopping up the pores in the wood of fermenting tuns in breweries.

3½ oz. shellac, 3½ oz. dammar resin, 2 quarts alcohol.

Put the resin into a bottle, pour on the spirit, well cork, and stand the bottle in a warm place until the resins are dissolved, occasionally shaking the bottles to hasten the solution of the resins. The varnish thus prepared is not fit for use until a turbid fluid has been formed. It is not necessary to filter it.

Have the barrels perfectly dry, and before using the cementing glaze dry them out and heat them by a hot current of air,

then quickly cover the insides with a coat of lacquer; and when it has dried so far as to no longer run, set it on fire. When it burns brightly, put the lid on and cover over with an old sack to exclude all access of air and so extinguish the fire; and before removing the lid let the barrels cool; a thin layer of the glaze will remain adhering so tightly to the sides of the barrel that it will never crack off.

Glaze for Closing Pores of Barrels, Vats, &c.

2 parts plaster of Paris, 1 part finely-powdered asbestos, bullock's blood.

Mix the solids in the blood to form a thick mass, but so that it can be worked with a brush.

Apply a uniform coat of the compound to the dry wood, and after a few hours give a second coat, to which it is advantageous to add a small quantity of linseed oil varnish. If necessary to dry the barrel, quickly suspend a basin with live coals in it; but the heat should be moderate, and it is preferable to let the barrel stand for a few days in a dry warm room.

Before using this cement, heat the barrel with steam, and then allow it to dry out. If properly done, the layer of glaze will adhere tightly, never show cracks, nor scale off. As an example, the glaze on a vat used for nine months for boiling starch with sulphuric acid was well preserved, and, in fact, had become somewhat harder. As the process is very cheap and simple, and the materials are entirely harmless, and impart no taste or odour to liquids brought in contact with them, this glaze is especially adapted for use in breweries, distilleries, starch manufactories, and other industries where wooden vessels are exposed to the action of acids.

Glue Cement for Wood and Metal.

Add powdered chalk to common glue; the result is a capital glue for wood and metal.

Glue Cements to Resist Moisture.

No. 1.—Mix 1 part glue, 1 part black resin, ½ part red ochre, with the least possible quantity of water.

No. 2.—4 parts glue, 1 part oxide of iron.

No. 3.—8 parts of carpenters' glue (melted), 4 parts linseed oil boiled to varnish with litharge.

Well mix together.

No. 4.—4 parts of the last mixture and 1 part Venetian turpentine.

The first three of the above dry in about forty-eight hours, and are very useful to render the joints of wooden casks, cisterns, &c., water-tight, also to fix stones in frames. The last serves to cement wood and even metals to each other. A good cement for fixing wood to glass may be made by dissolving isinglass in acetic acid in such quantities that it becomes soiid when cold. To apply it, heat the cement. All the above cements resist moisture.

Grouvelle's Oil Cement.

5 parts whitelead, 2 parts redlead, 4 parts dry clay.
Mix with boiled linseed oil.

Hop Pitch, for Glazing Inside of Barrels.

Melt good brewers' pitch for half an hour with 5 per cent. hops; pour the mixture through a fine wire cloth, and finally add 0.01 per cent. oil of hops.

This pitch (it is claimed) contributes to make the beer durable and aromatic.

Lime Cement for Joiners' Use.

Mix 20 parts flour, 10 parts slaked lime, and 3 of linseed-oil varnish.

Mahogany Cements.

No. 1.—4 oz. of beeswax, 1 oz. Indian red, 1 oz. yellow ochre.

Melt the wax, and then stir in the colouring matter, using enough yellow ochre to give the required tint.

No. 2.—This is used to fill up holes and cracks on mahogany. It consists of shellac melted and coloured as above.

Putty.

This may be looked upon as a cement. It is prepared by mixing fine whiting with linseed oil or linseed-oil varnish, the latter drying more quickly. The whiting should be passed through a sieve of 42 to the inch mesh. It should be thoroughly dry before sifting, and be thoroughly incorporated with the oil. This is a tedious operation, but unless it is

properly compounded the putty is next to useless, a lump of dry whiting in it would spoil all its adhesiveness. Keep the putty in oiled paper or under water, to prevent a hard skin forming on it. Whitelead is sometimes mixed with the putty, and other pigments, to give colour as desired. Hard putty may be softened by rolling between the hands.

—Facing Putty.

This putty is particularly useful for stopping small flaws. It consists of whiting, whitelead, and a small quantity of litharge mixed to the consistence of putty with linseed oil.

—Putty for Floors.

No. 1.—1 part litharge, 2 parts plaster of Paris, 1 part glue, 8 parts water, 4 parts cement, 2 parts sawdust.

Melt the glue and stir in the other ingredients.

No. 2.—5 parts caseine, 3 parts ammonia, 30 parts water, 3 parts burned lime.

Slake the lime with the water and add the caseine and ammonia.

—Putty for Filling Cracks in Floors to be Varnished.

2 parts glue, 14 parts water, 4 parts plaster of Paris, 2 to 4 of litharge.

Dissolve the glue in the water, and then work in the other ingredients.

—Soft Putty.

No. 1.—10 lb. of whiting, 1 lb. whitelead, linseed oil, ½ gill of the best olive oil.

Mix the whiting and whitelead with the necessary amount of oil to render the putty of the proper consistence, the olive oil being added to the linseed oil before kneading. The object of using this oil is to prevent the whitelead hardening, and it preserves the putty in a state sufficiently soft to adhere at all times, and not, by getting hard and cracking off, suffering the wet to enter, as is often the case with ordinary hard putty.

No. 2.—A very strong putty is made by boiled oil and whiting for exposed situations, as skylights, but is not adapted for keeping; it gets too hard.

No. 3.—Putty for use on inside work may be improved by the addition of whitelead.

No. 4.—This putty gets hard almost immediately, so should be made only as wanted. It is composed of redlead in powder, mixed with boiled oil and turpentine varnish, and is used for fronts of houses or any place requiring a hard putty.

No. 5.—Some manufacturers prepare a drying oil for the purpose, by melting 2 lb. of resin, and mixing it with 9 lb. of linseed oil, the resin being used for economy's sake—in plainer terms, for the purposes of adulteration.

—French Putty.

No. 1.—One authority prepares this substance by boiling 7 parts of linseed oil with 4 parts of burnt umber for two hours. Then 5½ parts of chalk and 11 parts of whitelead are then added, and the whole well mixed.

This putty is very endurable, and even though the wood be not previously painted, it adheres well thereto.

No. 2.—1 part gum arabic, 4 parts potato starch, 2 parts water.

Dissolve the gum in the water and then stir in the starch.

This putty makes a fair filling for preparing the pieces of soft, porous wood to take a coat of polish or varnish, if well applied.

—Imperishable Putty.

Boil 4 lb. of brown umber in 7 lb. of linseed oil for two hours, stir in 2 oz. of wax, and then stir in 5½ lb. of chalk, and 11 lb. of whitelead, and thoroughly incorporate the whole so that every component is equally mixed. This is similar to French putty with the addition of wax.

—Putty for Joints in Floors and Soft Wood.

No. 1.—Is for floors which are to be scrubbed.

1 part caseine, 7 parts water, ¾ part spirits of ammonia, ½ part burnt lime.

Mix all together.

Prepare both this and No. 2 just before using it.

No. 2.—2 parts glue, 1 part water, 7 parts cement, 3 to 4 parts sawdust.

Dissolve the glue in the water, and then work in the other ingredients.

—Lime Putty, for Filling Cracks in Wood.

No. 1.—5 parts rye flour, 1 part slaked lime, 1 part linseed-oil varnish, umber.

Make into a putty by kneading the solids in the oil, and adding the umber in sufficient quantity to produce the tone of colour required.

No. 2.—1 part powdered slaked lime, 2 parts rye flour, 1 part linseed-oil varnish, water.

Mix all to a paste and use enough water to thin the mass.

—Powdered Wood and Glue Putty.

20 parts water, 1 part glue, finest sawdust as much as may be required.

Dissolve the glue by boiling in the water and then stir in the sawdust.

Powdered Wood and Oil Putty.

Fine sawdust, linseed oil varnish.

Knead the sawdust into a dough by working it with the varnish, and rub up to a pasty mass.

Turners' Cements

No. 1.—1 part resin, 1 part pitch, 2 parts beeswax, brickdust finely ground to produce desired consistency.

Melt the three first components, and then stir in the brickdust to form a stiff putty.

No. 2.—2 parts resin, 2 parts Burgundy pitch, 2 parts beeswax, $\frac{1}{16}$th part yellow wax.

Melt and mix together.

No. 3.—8 parts black resin, 1 part yellow wax.

Melt together and pour into a tin canister.

No. 4.—Use a mixture of resin, turpentine, and yellow wax, then add a little powdered sealing-wax.

No. 5.—Melt 1 lb. of resin in a tin can over the fire, and

when melted, add 4 oz. of pitch; while these are boiling, add brickdust until, by dropping a little on a cold stone, you think it hard enough. In winter you may find it necessary to add a little tallow.

By means of this cement a piece of wood may be fastened to the chuck, which will hold when cool, and when the work is finished it may be removed by a smart blow with the tool. All traces of the cement may be removed from the work by repeated applications of benzine. To use this cement, chip off as much as will cover the chuck to the $\frac{1}{16}$th of an inch, spread it over the surface in small pieces, mixing it with $\frac{1}{8}$th of its bulk of guttapercha in thin slices, then heat an iron to a dull red heat, and hold it over the chuck till the mixture and guttapercha are melted and liquid. Stir the cement until it is homogeneous, chuck the work, lay on a weight to enforce contact, leave it at rest twenty minutes.

No. 6.—The following cement is one of very general use, and serviceable for the use of turners and artisans in general. 16 oz. of whiting are to be reduced to a fine powder, and then heated to redness, so as to drive off all the water. When cold this is mixed with 16 oz. of black resin and 1 oz. of beeswax, these two having been previously melted together, and the whole stirred till of uniform consistence.

Waterglass Cement, for Preserving Wooden Articles.

Barrels and such articles treated as follows are very durable and easily cleaned.

Heat commercial waterglass diluted with about 25 per cent. of water, and apply a coat of the hot solution to the barrel. When thoroughly soaked in, repeat the application, allow it to dry, and then give a coat of a solution of 1 part of sodic bicarbonate in 8 parts of water. By the latter application the carbonic acid of the bicarbonate separates the silicic acid from the waterglass soaked into the pores of the wood, which, so to speak, silicifies the wood and renders it capable of resisting the penetrations of liquids.

Wood, Cements for Stopping Cracks in.

No. 2.—Make a paste of 1 part of slaked lime, 2 parts rye meal, with a sufficient quantity of linseed oil.

No. 3.—Dissolve 1 part of best glue in 16 parts of water, and when almost cool stir in sawdust (of hard wood) and prepared chalk a sufficient quantity.

No. 4.—Use oil varnish thickened with a mixture of equal parts of whitelead, redlead, litharge, chalk, and wood.

No. 5.—A hard cement. This cement is as hard as stone when dry, and will adhere firmly to wood.

Melt 1 oz. of resin and 1 oz. of pure yellow wax in a hand-pan, and thoroughly stir in 1 oz. of Venetian red until a perfect mixture is formed. Use while hot.

Wood to Metal, Cement for Uniting.

An excellent cement for uniting articles of wood with metals, glass, stone, &c., may be obtained by dissolving glue in boiling water, and making it of the same consistence as that of cabinet-makers' glue; then add, while stirring, a sufficient quantity of wood ashes to produce a varnish-like mixture. While hot, the surfaces to be united must be covered or coated with the glue compound and pressed together. When cold, the surfaces will be found firmly united, and much force will be needed to separate them again.

Wood to Stone, Cement to Fasten.

No. 1.—Melt together 4 parts pitch and 1 part wax, and add 4 parts brickdust or chalk. This cement has to be warmed for use, and applied thinly to the surfaces to be joined.

No. 2.—Put any quantity of fine sawdust of the same kind of wood into an earthenware pan, and pour boiling water on it; stir it well, and let it remain for a week or ten days, occasionally stirring it; then boil it for some time, and it will be of the consistence of pulp or paste.

Put it into a coarse cloth and squeeze all the moisture from it. Keep for use, and when wanted, mix a sufficient quantity of thin glue to make it into a paste; rub it well into the cracks, or fill up the holes in grain work with it; when quite hard and dry clean the waste off, and if carefully done you will hardly discern the imperfection.

Wooden Vessels, Cement for.

Make a mixture of lime, clay, oxide of iron, separately calcined and reduced to fine powder.

Mix well and keep it in a close vessel, and mix with the requisite quantity of water when required for use.

Wood-preserving Composition.

Boil in an iron boiler 4 to 8 parts of linseed oil with 50 parts of resin, 40 parts of pulverised chalk (whiting), and 2,000 to 3,000 parts of sharp white sand. When the paste is thoroughly boiled, add 1 part of cuprous oxide, and finally 1 part of sulphuric acid. The mass is then thoroughly stirred together and applied while hot to the wood with a stiff brush. If the mass is too thick, it should be thinned with linseed oil.

VIII. GLUES FOR VARIOUS PURPOSES.

Manufacture of Glue, and Hints as to its Use.

Glue is a cement used for joining pieces of wood together, and has for its chief constituent a substance called gelatine, obtained from the cuttings of hides, skins, tendons, and other refuse parts of animals, as well as from the cuttings of leather and parchment, which, after being well soaked in milk of lime—to dissolve any blood, flesh, or fat—are thoroughly washed in a stream of water to remove the lime. The material is then boiled in water until the required adhesive strength is obtained, when the liquid is run off into a cistern and clarified with powdered alum, which precipitates in the form of sulphate any lime that may remain, as well as other impurities. Before cooling it is drawn off into moulds, and is then in the form of size, which, when cut into slices and dried in the air, hardens into glue.

To prepare this article, the parings of skins and hides steeped in lime water are used. The best glue is obtained from the waste of calf and sheep skins, while the glue obtained from horse hides is dark and poor in quality.

"Glue stock" is the technical term given to the materials from which glue is boiled. Besides the waste from tanneries, from which 44 to 46 per cent. of glue may be obtained, "stock" is procured from the following sources:—

The waste from preparing sheep, goat, and kid skins for various purposes.

The scarf skin of bullocks' hides and waste in fleshing the hide, from which about 30 per cent. of glue is obtained.

The tendons, buttock pieces, and generative organs of cattle, which yield about 35 per cent. of glue. Horse sinews, yielding 15 to 18 per cent. of glue.

Bullocks' feet and parchment shavings, which yield about

62 per cent. of glue. Old gloves, rabbit-skins from which the hair has been removed by hatters, also dog and cat skins. The waste of tanneries, such as foot, head, and buttock, which tanners cut off before tanning; earlaps of sheep and cows, sheeps' feet with the tendons, small bones, and waste of skins. When this material is good 38 to 42 per cent. of glue may be obtained.

Skins unfit for tanning, or such as have been used for packing purposes; for instance, those in which indigo is brought from South America. This stock yields a percentage of 50 to 55 of glue.

The waste of Buenos Ayres skins, which yield about 50 to 60 per cent. of glue. Lastly, the cartilages and other waste of fish is used for making glue. This is usually used for producing gelatine or isinglass, as will be seen from the above. The material converted into glue varies greatly; 500 lb. of good material yield about 50 per cent. of glue, while, if the stock be poor, 650 lb. to 1,200 lb. of it may be required for the same purpose.

It is usual to steep the glue stock in lime water in order to preserve it; but before boiling it into glue it must be again steeped, and this becomes especially necessary when, after being washed in water, the waste assumes a bluish colour and becomes soft; this is a sure sign that it contains too little lime, and it must then remain for a few days in thin lime water, when it is dried. The best manner of doing this is the following :—

Steep the waste in clean water for twenty-four hours, then place it in a basket to drain off the water. After draining, steep it for several days in thin lime, and replace it in the basket to drain, and wash off with clean water, and dry. This steeping in lime water is of the utmost importance, as the quality of the glue is mainly dependent upon it. Too much steeping yields a small quantity of glue, but of an excellent quality, while that obtained from glue stock steeped only for a short time is dark. Fresh or green (*i.e.* undried) glue stock is best stored in wooden or brick vats during the winter. These receptacles should contain dilute lime water, which should be well stirred when putting in the waste. The glue stock to be boiled is used either as wet or dry waste, and the boiling is best done in the open air.

In using wet waste, put the glue stock into a vat, and cover

it with water, and allow the stock to soak for twelve hours, then draw off the water to drain the stock, and wash off all the lime that still adheres. Then take out the stock, pile it in heaps, and expose it to the air from twelve to twenty-four hours to evaporate the acrid constituents. The stock is then ready for boiling. When using wet waste no further preparation is necessary than to steep it in lime, wash this off, and dry the stock before boiling it. The boiling process is performed in a copper or iron boiler, which should be large enough to hold one-tenth more water in gallons than the amount of stock in pounds that is to be boiled. Thus, to boil 250 lb. of stock, the boiler should be capable of holding at least 275 gallons of water. The shape of the boiler should be somewhat of an inverted cone—*i.e.* shaped like a common pail, the diameter being less than the height—and to prevent the glue being burnt a double bottom bent inwards should be given to it. A discharge pipe and cock, through which to draw off the fluid glue, should be inserted near the bottom. To prevent the glue lying immediately on the bottom, and to prevent it burning, a perforated bottom of sheet iron or copper should be placed in position before putting in the stock to be boiled. Warm water should be run on to the stock in the boiler, and this can be provided by a suitable adaptation of pipes, whereby the escaping steam from the boiler can be run into a tank that is fixed higher than the top of the boiler.

When everything is in proper shape the bone, sinews, and other constituents are placed in the boiler, and on the top of this a sufficient quantity of water to fill the boiler. If this holds 275 gallons, about 125 gallons of clean water are added, if wet material is used, and about 225 gallons to dry stock. The mass is now boiled until a sample taken from the boiler coats to a jelly. This for wet material requires generally one hour; for dry stock, two hours. The glue will be ready for cutting when a sample poured into a cup can be conveniently taken out when cold. The fluid is then drawn off into the cooling vat (clarifying vat). This is also provided with a discharge pipe and cock, and placed high enough to allow of a bucket being conveniently put under it. When the glue has become clear it is drawn off and poured into boxes (moulds).

A fresh quantity of waste is added to the material remaining in the boiler and boiled. This is called the second boiling and is treated in the same manner as the first.

Good glue should be of a light brown colour, semi-transparent, and free from water or cloudy lines. Glue loses most of its strength by frequent remelting; therefore glue which is newly made is preferable to that which has been reboiled. The hotter the glue, the more force it will exert in keeping the joined parts glued together. In all large and long joints it should be applied immediately after boiling. Apply pressure until it is set or hardened.

The absolute strength of a well-glued joint is—

	lbs. per sq. in. across the grain.	lbs. per sq. in. with the grain.
Beech	2,133	1,095
Elm	1,436	1,124
Oak	1,736	568
Whitewood	1,493	341
Maple	1,422	896

It is customary to use one-sixth to one-tenth of the above value to calculate resistance which surfaces joined with glue can permanently sustain with safety.

To Prevent Glue from Cracking.

No. 1.—The dry air of rooms is a frequent cause of glue cracking. The addition of a little calcic chloride to glue prevents the disagreeable property of cracking. This it does owing to its deliquescent property, whereby it attracts moisture, and so prevents the glue from cracking. Glue thus prepared will adhere to metal, glass, &c., and can be used for putting on labels without fear of dropping off.

No. 2.—A small quantity of glycerine also prevents the cracking thereof for the same reason, viz., the attraction of moisture. The quantity to use must be modified according to circumstances. In both cases it should be borne in mind that such attraction of moisture lessens the adhesive property of glue.

Glue from Bone.

The bones are crushed to the size of peas, or else the waste obtained in preparing bone-meal is used. The bone material is first moistened with a solution of oxalic acid in water; then piled in heaps and left to itself, whereby spontaneous heating takes place. It is then steamed in a glue boiler, the manhole being left open during the process. When the ammoniacal combinations have been expelled, the material is subjected to

a pressure of 2 to 3 atmospheres, and boiling water poured in from time to time in order to completely dissolve the gelatine. The concentrated solution of glue, containing from 25 to 30 per cent. of dry substance, is finally pressed into a wooden vat, where it can be further concentrated, if necessary, by heating a steam pipe. The whole process occupies from five to six hours.

Glue from Caseine.

No. 1.—Dissolve caseine (see page 39 for method of making this solution) in a strong solution of bicarbonate of soda.

No. 2.—Dissolve caseine in a cold saturated solution of borax.

These preparations are superior to gum, and take the place of glue in many cases. This glue may be used for the backs of adhesive tickets.

Isinglass Glue.

Dissolve isinglass in water, and strain it through coarse linen, then add a little alcohol, and evaporate to such a consistency that when cold it will be dry and hard. This will be found to be more tenacious than common glue, and therefore preferable in many cases.

Parchment Glue.

Cut up 10 parts of parchment into small pieces, and boil them in 128 parts of water until the liquid is reduced to 80 parts; then filter the decoction through linen, and evaporate it over a slow fire until it is of the required consistence.

Russian Steam Glue.

100 parts good glue, 120 to 140 parts water, 5 to 6 parts nitric acid, 6 parts finely powdered sulphate of lead.

Soak the glue in the water, add the acid, and then, to give the compound the peculiar white colour of Russian glue, stir in the lead sulphate.

Tungstic Glue.

This glue has been suggested as a substitute for hard india-rubber, as it can be used for all purposes to which the latter is applied. It is thus prepared: tungstate of soda and hydro-

chloric acid. A compound of tungstic acid and glue is precipitated, which, at a temperature of 80° to 104° F., is sufficiently elastic to be drawn out into very thin sheets.

Compound Glue.

Take very fine flour, mix it with white of egg, isinglass, and a little yeast. Mix the materials and beat them well together. Spread then the batter, being made thin with gum-water, on even tin plates, and dry them in a stove, then cut them out for use. To colour them, tinge the paste with Brazil or vermilion for red, indigo, &c., for blue, saffron, turmeric, &c., for yellow.

Dry Pocket Glue.

Boil 12 parts of glue until dissolved, and in the hot glue stir in 5 parts of sugar, and evaporate the mixture until it hardens on cooling. The hard substance dissolves rapidly in luke-warm water, and is an excellent glue for use on paper.

Ether Glue.

Dissolve glue in nitric ether. The ether will only dissolve a certain amount of glue, therefore the solution cannot be made very thick. It will be about the consistency of molasses, and is much more tenacious than glue made with hot water. It is improved by adding a few bits of indiarubber cut into pieces the size of a nut.

Let the solution stand a few days, stirring frequently.

Hellier's Steam Glue.

100 parts of good glue, 200 parts of water, 12 parts of aqua-fortis.

Dissolve the glue in the water, and then add the nitric acid.

Spaulding's Glue.

Soak the glue in cold water, using only glass, earthenware, or china dishes; then by gentle heat dissolve in a small quantity of nitric acid sufficient to give the glue a sour taste like vinegar. About 1 oz. to every pound of glue is required.

Glues for Damp Wood.

No. 1.—Soak pure glue in water until it is soft, then dissolve it in the smallest possible quantity of proof spirit by the

aid of a gentle heat. In ¼ lb. of this mixture dissolve 20 grm. of gum ammoniac, and while liquid add 1 drm. of rectified spirit. Stir well and keep the cement liquefied in a covered vessel over a hot-water bath. This is practically a solution of glue in mastic varnish.

No. 2.—4 lb. shellac, 1 lb. borax.

Boil the two ingredients in water until the shellac is dissolved, and then concentrate by heat until of a pasty consistence.

Glue for Inlaying or Veneering.

Select the most transparent glue of a light brown, free from clouds and streaks, and dissolve it in water, and to every pint of solution thus made add ½ gill of the best vinegar and ½ oz. of isinglass.

Liquid Glue.

No. 1.—Soak gelatine in water, melt at a low heat, and add strong vinegar or acetic acid until it remains liquid when cold.

No. 2.—To make one gallon of the liquid cement:—about 1½ gallons of water, 3 lb. glue, ¼ lb. borax, 2 oz. carbonate of soda, or equivalent of any other.

Dissolve the glue and alkaline salts in the water by heat, and keep the solution at a temperature a few degrees below boiling for five or six hours. This continued application of heat renders the gum permanently liquid at the ordinary temperature. Allow the condiment to settle, and then evaporate the clear liquid to the required consistency.

No. 3.—3½ oz. ordinary gelatine, 1 pint water, ¼ oz. crude oxalic acid, calcic carbonate.

Mix the oxalic acid and water, and dissolve therein the gelatine, and keep the solution for five or six hours in a flask in a vessel of hot water; then pour it into a dish, dilute, and neutralise the acid with the chalk (calcic carbonate); filter, and evaporate at a moderate temperature.

The quantity of glue produced by this process is about double the quantity of gelatine used. The cement is very clear, slightly coloured, and very tenacious.

No. 4.—Best glue, vinegar, acetic or nitric acid.

Soak the glue in water, then melt it at an ordinary heat in the usual way, and stir in strong vinegar until the solution

remains a thick fluid when cool. To keep this glue fluid at ordinary temperature add a small quantity of acetic or nitric acid until this acid evaporates. The glue will remain liquid.

No. 5.—This glue is useful for wood and iron. 10 parts clear gelatine, 10 parts cabinetmakers' glue, 2½ parts alcohol, 2 parts alum, 20 parts acetic acid of 20 per cent. strength.

Mix all the ingredients with the acid, and heat together for six hours on a water bath.

No. 6.—Ordinary liquid glue.

Boil together for several hours 10 parts glue in 26 parts water, with the addition of 1½ part nitric acid.

No. 7.—3 parts glue broken up small, 12 to 15 parts of saccharate of lime.

Dissolve together, and on warming the glue rapidly dissolves, and remains liquid when cold without losing its strength. Any desirable consistency may be secured by varying the amount of saccharate of lime.

No. 8.—This is useful for mending glass and china.

Allow 2 oz. of gelatine to swell up in 4 oz. of water, and then add 2 oz. of acetic acid.

No. 9.—Liquid glue without acid.

4 oz. best white glue, 1 oz. whitelead dry, ½ pint water, 1 oz. alcohol.

Constantly stir the glue in the water until dissolved together with the whitelead by the heat of a water bath. Add the alcohol, and continue the heat for a few minutes. Lastly, pour out the mixture into bottles while it is still hot.

No. 10.—Put 8 oz. best glue and ½ pint water into a wide-mouthed bottle, and dissolve by aid of a water bath; then add slowly 2½ oz. strong nitric acid, stirring all the time. Effervescence takes place under generation of nitrous acid. When all the acid has cooled, keep it well corked and it will be ready for use at any moment.

No. 11.—Mix 1 part of common turpentine with 4 fluid oz. of absolute (*i.e.* 98 per cent.) alcohol. Shake well together, and let stand until the two fluids separate. Decant the turpentine (which will form the lower layer) from the alcohol, and mix it with 1 part of pure water. Shake thoroughly, and again set the bottles aside to allow the fluids to separate.

then from the water decant the turpentine (which this time will form the upper layer), and finally mix with the turpentine about 1 oz. powdered starch, and filter through paper.

No. 12.—A German authority gives the following formula for making a liquid paste or glue from starch and acid. Place 5 lb. potato starch in 6 lb. of water, and add 4 oz. pure nitric acid; keep it in a warm place, stirring frequently for forty-eight hours. Then boil the mixture until it forms a thick translucent substance.

Dilute with water if necessary, and filter through a thick cloth. At the same time another paste is made from sugar and gum arabic. Dissolve 5 lb. gum arabic and 1 lb. sugar in 5 lb. water, and add 1 oz. nitric acid, and heat to boiling. Then mix the above with the starch paste. The resultant paste is liquid, does not mould, and dries on paper with a gloss. It is useful for labels, wrappers, and fine bookbinding work.

No. 13.—6 parts glue cut up small, 16 parts water, 1½ part sulphate of zinc, 1 part hydrochloric-acid gas.

Pour the water over the glue, and let the mixture stand for a few hours; then add the sulphate of zinc and gas. Keep the mixture at a temperature of 175° to 190° F. for ten or twelve hours. This glue does not congeal, and may be used for joining all articles, even china, glass, mother-of-pearl, &c.

No. 14.—Fill a bottle two-thirds full of common glue, and then fill up with whiting. Cork it up and set it by three or four days. It will dissolve without the application of heat.

—Cold Liquid Glue.

2 to 2½ parts crude nitric acid, 40 to 50 parts water, 25 parts glue.

Mix the acid and water, then soak the glue in the mixed fluids for twenty-four hours, and then heat the mixture until it is homogeneous.

The quantity of acid used depends on the quantity of the glue.

—Russian Liquid Glue.

Soften 50 parts best Russian glue in 50 parts warm water. Add slowly from 2¾ to 3 parts aquafortis (nitric acid), and 3 parts powdered sulphate of lead.

—Liquid Glue for Glass, China, Pearl, &c.

8 parts water, 3 parts glue, broken up small, ½ part hydrochloric acid (spirits of salts), ¾ part sulphate of zinc.

Dissolve the glue in the water, then add the acid and zinc salt, and heat the mixture to 175° to 190° F. for ten to twelve hours.

The glue does not again congeal, and, if necessary, can be still further clarified by allowing it to settle, and then filtering.

Marine Glues.

No. 1. *Jeffrey's Formula.*—This preparation is made by dissolving 1 part of indiarubber in crude benzine and mixing the solution with 2 parts of shellac by the aid of heat.

The waterproof character of this cement in connection with its slight elastic flexibility, the ease with which it is applied when warm, and the promptness with which it sets in cooling, make it a most useful substance in many applications to house construction and furniture, as well as on board ship, where it was originally intended to be applied.

No. 2.—1 oz. caoutchine, 2 oz. genuine asphaltum, benzole or naphtha.

Dissolve the caoutchine in the liquid by digestion and occasional shaking, and then gradually add the asphaltum. The solution should be in about the consistency of molasses.

No. 3.—Take of coal naphtha 1 pint; pure (not vulcanised) rubber 1 oz. cut in shreds, and macerate for ten or twelve days, and then rub smooth with a spatula on a slab; add at least enough to melt, 2 parts shellac by weight to 1 part of this solution.

To use this compound, melt it at a temperature of about 248° F.

No. 4.—Shellac and caoutchine dissolved in separate portions of naphtha and mixed.

—Elastic Marine Glue.

This is a solution of unvulcanised rubber, in a suitable solvent, as benzole, bisulphide of carbon, naphtha or chloroform principally, and for coating ropes and other materials exposed to the alternate action of air and water.

It can be cheapened by adding very fine sand or whiting.

—Marine Glue for Damp Walls.

10 lb. caoutchine, 10 lb. whiting, 20 oz. oil of turpentine, 10 of bisulphide of carbon, 5 of resin, and 5 of asphaltum.

Put all the ingredients into a suitable vessel (as an earthenware jar) and stand in a warm place, giving a shake frequently.

Scrape the wall smooth and clean and apply the glue with a broad brush to the wall on the damp place, and about eight inches higher than the line of dampness; and before the glue is dry lay on plain paper, which will adhere tightly. On the plain paper the wall-paper can be pasted in the usual manner.

If carefully done the wall-paper will always remain dry.

—Hard Marine Glue.

This glue is waterproof, and can be used to cement metal, wood, glass, stone, pasteboard, &c., &c.; especially adapted for caulking vessels.

10 parts caoutchine, 12 parts refined petroleum, 20 parts asphaltum.

Put the caoutchine in a linen bag, and suspend it in the vessel of petroleum so that only one-half of the bag is immersed in the fluid, and allow the vessel to remain undisturbed for a fortnight in a warm place. Then melt the asphaltum in an iron saucepan and pour in the caoutchine solvent (out of contact with the fire or naked light) in a thin stream, and heat the mixture (by means of a water-bottle is the best), and keep on stirring until the mixture is of a uniform mass; then pour it into greased moulds, where it forms into dark brown or black plates difficult to break.

Melt the glue by standing the mould in a vessel which stands in boiling water, to prevent its burning, which it is very apt to do as it is a bad conductor of heat. When it is liquid remove the vessel from the water-bottle and place it on a fire where it can be heated, if necessary to make it more fluid, to 300 F., carefully stirring to prevent burning.

If possible, the surfaces to be glued together should be heated to 212° F., as the glue can then be slowly applied. The thinner the layer of glue in cementing smooth surfaces the better it will adhere. But a somewhat thicker layer is required for rough surfaces (for instance, boards not planed) the excess of glue being forced out by strong pressure. Generally speaking, it is best to subject all articles cemented together by marine glue to as strong a pressure as possible until the glue

is congealed. Square vats, perfectly watertight, can be constructed by means of thin glue. Wooden pins, dipped in the warm glue, should be used for putting the vats together.

Moisture-proof Glue.

Dissolve 16 oz. glue in 3 pints of skim-milk. If a stronger glue be wanted, add some powdered lime.

Mouth Glues.

No. 1.—1 part isinglass, ¾ part parchment shavings, ¼ part rock-candy.

Soak all the articles in water for a few days, then put the mixture into a pitcher and boil, stirring constantly to keep the mass from burning. When it is boiled down to about one-half the quantity strain the fluid through a coarse cloth, and when about half cold pour a thin layer of it upon a stout slab, and cut into strips.

No. 2.—1 part of glue prepared as directed below, ½ part white sugar.

Break up the glue and soak it in water for two days, then pour off the water and melt the glue over a moderate fire. When melted, mix in the sugar thoroughly and stir into moulds, and allow it to remain undisturbed for a few days.

Moisten a piece of the glue with the tongue, and rub it on the surfaces you wish to stick together.

Books, Glue for.

12 parts of glue, 8 parts of water, 8 parts of white soap in shavings, 6 parts of powdered alum.

Dissolve the glue in the water at a moderate heat, then stir in the scraped soap, and when that has dissolved add the alum, stirring the mass constantly.

The sheets of paper may be either sponged with the fluid or they may be dipped in it.

Bookbinders' Glue.

Use best carpenters' or white glue, to which, after soaking and beating, one-twentieth of its weight of glycerine is added.

Fly-papers, Glues for.

No. 1.—A glue for these torture-inflicting articles is made by melting together 6 parts of colophony, 4 parts of rapeseed oil, and 3 parts of resin.

No. 2.—Or else use this composition :—16 parts of resin, 8 parts of turpentine, 8 parts of rapeseed oil, and 1 part of honey.

No. 3.—Boil to a paste 16 oz. of resin, 3½ oz. of molasses, and 3⅓ oz. of linseed oil.

No. 4.—6 parts of colophony, 4 parts of rapeseed oil, and 3 parts of resin. Melt all together.

No. 5.—8 parts of resin, 4 parts of turpentine, 4 parts of rapeseed oil, ½ part of honey. Melt the resin and stir in the turpentine (away from the fire) and the oil, then mix the honey, and stir well.

To use these mixtures smear on paper, or for use in the garden to catch green-fly, &c., smear them on sticks, and plant them in a pot filled with sand.

Glue for Fastening Labels on Flower-pots.

Use thin paper for label, and attach this with white gelatine in solution, to which has been added 1 per cent. of bichromate of potash. This must be done in a dark or obscure room ; then expose the labels to sunlight. After writing, varnish them with a solution of shellac in alcohol.

Waterproof Glues.

No. 1.—Dissolve 5½ drm. of mastic and 5½ drm. of sandarach resin in ½ pint of alcohol, and add 5 drm. of turpentine. Place the solution in a glue boiler upon the fire, and gradually stir into it an equal quantity of a strong hot solution of glue and isinglass. The mixture is ready for use after straining it while hot through a cloth.

For glueing mineral substances, it is best to stir 5½ drm. of finely pulverised glass into the strained mixture. Articles glued with this mixture can be placed under water without danger of the glued parts separating.

No. 2.—Tannic acid dissolved in a small quantity of soft water renders glue insoluble.

No. 3.—This formula, from a French authority, is claimed to produce an impermeable glue, but the writer finds it an unsatisfactory one, as the glue takes a long time to dissolve, and when dissolved the compound takes a long time to dry and harden.

Soak ordinary glue in water until it softens, and remove it

before it has lost its primitive form. After this dissolve it in linseed oil over a slow fire until it is brought to the consistence of a jelly.

No. 4.—This is a better formula than the above. Melt common glue with the smallest possible quantity of water, add to this 3 degrees linseed oil, rendered drying by boiling it with litharge. While the oil is being added the ingredients must be well stirred so as to mix them thoroughly.

No. 5.—10 parts thick solution of glue, 5 parts linseed-oil varnish, 1 part litharge.

Boil all together for ten minutes, and use the compound while hot.

No. 6.—Take 10 parts of a very thick solution of glue, 5 parts linseed-oil varnish, and 1 part of litharge.

Boil for ten minutes, and use while it is hot.

No. 7.—12 parts of glue, 3 parts yellow wax, 4 parts turpentine, water.

Dissolve the glue in the water by heat, add the resin, and when melted, the turpentine, and warm up all together by the heat of a water-bath.

No. 8.—1 part glue, powdered, 1 part linseed-oil varnish.

Make the varnish boiling hot and then dissolve in it the glue and well mix.

Warm the planed sides of the wood to be joined, apply the glue warm, and press the pieces together.

White Glue.

A foreign writer says that to add oxalic acid and white oxide of zinc in the proportion of 1 per cent. to glue gives a whiter and clearer product than any of the measures now in use. The glue should first be reduced with water, and heated to a thick syrup, and the chemicals added while the mass is hot.

Frozen Glue.

While the glue is gelatinous it is sliced, placed on nets, and allowed to freeze by natural cold. Of course, the process can only be conducted in cold weather. The product is porous, and much more bulky than hard glue, but is a better article, as it dissolves more easily.

Glue for Dressing Wounds.

Cabinetmakers and woodworkers generally are familiar with the uses of glue in dressing tool-cuts and other slight wounds incident to their calling. The addition of acetic acid to the glue and a little otto of roses (not an inexpensive thing to add) will cover the odour of the glue and acid. This compound spread on paper or muslin makes a good substitute for adhesive plaster for surgical use. It is easily and quickly prepared by simply putting in a vessel of boiling water a bottle containing 1 part of glue to 4 parts, by measure, of the acid, and letting the bottle remain in this bath until the glue is fully dissolved and mixed with the acid. Common glue may be added and officinal acetic acid, to be had at any druggist's.

The mixture should be kept in a wide-mouthed bottle, well stoppered by a long cork, which can always be removed by heating the neck of the bottle. Care should be taken to keep the mouth of the bottle clean by wiping it well with a cloth dipped in hot water.

To Convert Glue into Gelatine.

Soak 5 lb. of good glue for two days in 1½ gallon of strong vinegar, with 1 oz. of which saturate 40 to 45 gr. of potassic carbonate. Then pour off the vinegar and place the glue in a sieve suspended in a vat of cold water, and allow it to remain twelve hours to remove the acetates adhering to the glue, which will now be as clear as glass with a yellow tint.

When this prepared glue is poured upon glass plate it gives white sheets of gelatine. They are somewhat more brittle than those obtained from bone glue; but this difficulty is overcome by adding more or less glycerine, according to the season of the year. In this manner gelatine can be produced which binds better than that obtained from bones, and at less cost.

IX. OFFICE PASTES, GUMS, AND WAFERS.

Adhesive Paste.

No. 1.—Take 4 oz. common gelatine in small pieces and steep it in 16 oz. of water until it becomes soft, then, by the heat of a water-bath, dissolve it, and while still hot pour into a mixture of 2 lb. of good flour paste and 1 part of water. Heat the whole to boiling and, when thickened, remove from the fire. While cooling, add 6 drm. silicate of soda and stir into the mixture with a wooden spatula. This preparation will keep good for an indefinite period and is very adhesive. The addition of 2 drm. of oil of cloves is an improvement.

No. 2.—Soften 4 parts by weight of glue in 15 parts cold water for fifteen hours, then heat the mixture until it is clear. Add 65 parts boiling water. In another vessel stir 30 parts starch paste in 20 parts water. Into this pour the glue ; stir well and, in cooling, add 10 drops of carbolic acid to act as a preservative.

—Flour Paste.

No. 1.—1 quart water, $\frac{3}{4}$ oz. alum.

Dissolve and, when the fluid is cold, add flour to make it of the consistence of cream ; then bring it to a boil, stirring all the while.

No. 2.—Hard paste. To No. 1 add a little powdered resin and a clove or two before boiling.

This will keep for months, and when dry it may be softened with water.

No. 3.—Mix 1 lb. of rye flour in lukewarm water, to which has been added 1 teaspoonful of pulverised alum. Stir until free from lumps. Boil in the regular way, or slowly pour on boiling water, stirring all the time until the paste becomes

stiff. When cold add a full 4 oz. of common strained honey (genuine bee honey, no patent mixture). Mix well. In labelling tin articles always paste the tin (or other work) and apply the labels.

—Clean and Durable Pastes.

No. 1.—Take a quart of water and dissolve in it a teaspoonful of pure powdered alum; stir into this enough of flour to make a thick cream. Break up every little lump of flour until the mixture is smooth. Stir in next a teaspoonful of powdered resin; now pour in a cupful of boiling water. Pour into an earthenware vessel, cover it up and keep it in a cool place. Add a few drops of oil of cloves. Whenever you want to use any of it take what you need and soften it with a little warm water.

No. 2.—Dissolve 2½ oz. gum arabic in 2 quarts of warm water, and thicken to a paste with wheat flour, and to this add a solution of alum and sugar of lead, 1½ oz. of each in water. Then heat the mixture and stir it until it is about to boil, and then cool it. To thin it if necessary, add gum solution.

—Durable Paste.

4 parts glue, 80 parts water, 30 parts starch paste, 20 parts cold water, 10 drops carbolic acid.

Allow the glue to soften in 15 parts of water for some hours, then heat moderately until the solution becomes quite clear, and stir in 65 parts more water. Separately mix the starch paste with the 20 parts of cold water, so that a milky fluid is obtained without lumps. Pour the boiling glue into this with constant stirring, and the whole kept at the boiling temperature. Allow the mixture to cool and then add the carbolic acid.

This paste has extraordinary adhesive power and may be used for either paper or cardboard. It must be preserved in closed bottles to prevent evaporation of the water, and will keep good for years.

Banknote or Mouth Glue.

Dissolve 1 lb. of fine glue or gelatine in water, evaporating it till most of the water is expelled, adding ½ lb. of brown sugar and pouring it into moulds.

This glue is also made with 2 parts of dextrine, 2 parts water, and 1 part spirit, but the best formula is to dissolve by the aid of heat, fine glue, as parchment glue or gelatine, with about a quarter or one-third of its weight of brown sugar, in as small a quantity of water as possible. Then, when perfectly liquid, it should be cast into thin cakes on a flat surface very slightly oiled, and, as it cools, cut up into pieces of a convenient size. When required for use moisten one end. A piece kept in the desk or work-bench is exceedingly convenient.

Billstickers' Paste.

Stir into flour-paste alum in powder in the proportion of 1 oz. to every 666 oz. of flour used in making the paste.

Any paste will not long resist the action of wet weather, but it may be made to do so by giving the bill, after sticking it, a wash of soap-water, sugar of lead solution, or a solution of crude lac in naphtha.

Cardboard, Paste for Making.

No. 1.—This formula is that of an architect who recommends to every 2 teaspoonfuls of the best wheat flour to add a teaspoonful of common moist or brown sugar, and a few drops of corrosive sublimate (solution), the whole to be boiled and continuously stirred to prevent jelly lumping till of the right thickness. To prevent mouldiness a few drops of some essential oil, as lavender or peppermint.

In putting or jointing together different thicknesses of cardboard he recommends 6 oz. of best gum arabic, 1 oz. or less of moist sugar, 1 teaspoonful of lavender or other essential oil, and a tablespoonful of gin. The whole to be well mixed in cold water to the consistency of a thick syrup, no heat being in any way applied.

No. 2.—Dissolve 180 gr. of best French glue in 180 gr. of water, by soaking and heating; then add a solution of 1 gr. of shellac in 6 gr. of alcohol, and stir well as long as the solution is warm. Mix also 35 gr. of dextrine in 50 gr. of alcohol and 25 gr. of water, until the solution is completed and has acquired a clear brown colour. Mix this solution with that of the glue, and pour the whole into a suitable vessel in which it may solidify. When wanted for use cut off a small piece, and liquefy it by warming.

Cardboard or Pasteboard, To Cement.

Fuse together good pitch and guttapercha (about equal parts), and to 9 parts of the mixture add 3 parts of boiled oil and $\frac{1}{8}$th part of litharge. Continue the heat while stirring until thorough union of the ingredients. This is applied hot or cooled somewhat, and thinned with a small quantity of benzole or turpentine.

Chinese Paste.

9 parts bullock's blood, 1 part quicklime.

Beat to a paste; and, for use, beat to a proper consistence with water.

Chinese Blood Cement.

This cement is in general use in China to make wooden and pasteboard vessels, willow ware, &c. It is waterproof.

100 parts slaked lime, 75 parts beaten bullock's blood, 2 parts alum.

Well mix all together.

Chromium Glue.

Glue, when combined with chromates and exposed to light, loses its solubility in water, and can therefore be used for repairing valuable glass or china articles.

5 to 20 parts white glue, 20 parts water (dissolved together); 1 to 2 parts potassa bichromate, 10 parts water (dissolved together).

Dissolve the glue in boiling water, and stir in the solution of bichromate; well mix, and then pour the mixture into tin boxes, and allow it to congeal therein.

Take a sufficient quantity of the glue; melt it in a cup standing in boiling water; place a layer uniformly on the fractured surface, press them together, and expose the articles to the sun for a few hours.

Cloth, Paste for.

Use rye-flour paste, adding to it quarter the weight of flour of good glue.

As the paste is for immediate use there is no need of adding alum, gum dextrine, or any preservative.

Crystalline Cement for Wood or Paper.

Mix a very concentrated solution of salt with dextrine, and lay the thinnest coating of the fluid on the surface to be covered by means of a broad soft brush. After drying, the surface has a beautiful, bright mother-of-pearl coating, which, in consequence of the dextrine, adheres firmly to paper and wood. The coating may be made adhesive to glass by pouring over it hot ordinary shellac varnish.

The following salts produce the most beautiful crystalline coating—magnesia sulphate, soda acetate, tin sulphate. Paper must first be sized, otherwise it will absorb the liquid and prevent the formation of crystals.

Dextrine Paste.

Dissolve a sufficiency of dextrine in hot water to make of the consistencey of honey, and use this as a paste. It is strongly adhesive, and will keep a long time unchanged if the water is not allowed to evaporate.

Sheets of paper may be prepared for extempore labels by coating one side with the paste and allowing it to dry; when to be used, by slightly wetting the gummed side it will adhere to the glue. This paste is very useful in the office or laboratory.

Dry Pocket Paste.

6 parts glue, 2½ parts sugar.

Dissolve the glue in boiling water, add the sugar to the hot solution, and evaporate the mass until a test sample congeals on becoming cold. The hard mass dissolves quickly in luke-warm water, and is a paste adapted especially for paper.

Engravings, Paste for.

A thin paste is preferable to use.

Rice flour makes an excellent paste for fine paper-work, while a mixture of gum tragacanth and gum arabic forms a thinner mucilage than either of these two joins alone.

Fluid Paste.

No. 1.—10 lb. gum arabic, 2 lb. sugar, 1¾ oz nitric acid, water as required.

Dissolve the gum and sugar in the water, then add the acid, and heat to the boiling point.

The resulting paste is liquid, does not mould, and dries to a

transparent layer upon paper. It is especially well adapted for flaps of envelopes, fine bookbinders' work, &c.

No. 2.—10 lb. potato starch, 5 quarts water, 8 oz. nitric acid.

Mix the acid and water and pour it on the starch in a china or earthenware basin, put the vessel in a warm place, and allow it to remain twenty-four hours with occasional stirring. Then boil it until it becomes thickly fluid and very transparent. If necessary it should be diluted with water and filtered through a cloth.

Gelatine Paste.

This paste is good for mounting photographs.

1 oz. cooking gelatine, 10 oz. alcohol (95 per cent.), ½ to 1 oz. glycerine.

Soak the gelatine in cold water for an hour or more, take out and drain off all the water that will go, and then add it to the alcohol in a wide-mouthed bottle, and add the glycerine, more or less according as to whether the gelatine is to be soft or hard.

Glycerine Paste for Office Use.

Dissolve 2 oz. of gum arabic and 4 drm. glycerine in 6 oz. of boiling water.

Gum Arabic Paste.

No. 1.—16 oz. picked gum arabic, 24 oz. water, 16 oz. white sugar, 1 fluid oz. of orange flower water, 3 whites of eggs.

Dissolve the gum, add the sugar, and evaporate until it is of the consistence of thick syrup; then add the whites of eggs (about 3 to each pound of gum), previously beaten up with the orange-flower water, or other flavouring, and strain through muslin, and continue the evaporation until it will set readily when cooled.

No. 2.—8 lb. common gum arabic, 2 lb. white sugar-candy, 12 lb. water, and 1 spoonful starch powder.

Dissolve the gum and sugar in the water, then strain it through linen or a horsehair sieve. When it has become liquid put a part of it into a flat preserve-pot, add the starch powder, and mix the whole well together with an iron wire, which should always remain in the pot for that purpose. This gum

serves for an infinity of uses and never spoils. When it becomes dry add a little water to it.

Gum, To Preserve.

Either add a few drops of sulphurous acid as already mentioned, and allow the calcic sulphate to settle from the gum, and then draining the gum, or else add a few drops of oil of cloves, alcohol, or acid, which will preserve a quart of the mucilage from turning sour. A small quantity of dissolved alum will preserve flour paste.

Guttapercha Paste for Paper.

Dissolve 1 oz. of crude guttapercha in bisulphide of carbon to the consistency of mucilage, and apply to the edges of the paper where required.

Labelling, Paste for.

No. 1.—1 oz. gum tragacanth, 4 oz. gum arabic, 1 pint water, 14 grm. thymol, 4 grm. glycerine ; water.

Dissolve the gum in the pint of water, strain the solution, and add the thymol and glycerine, and enough more water to make 2 pints of fluid gum.

No. 2.—4 oz. of rye flour. Mix, strain, add 1 drm. nitric acid, beat until thickened, and finally add 10 drm. carbolic acid, 10 drops oil of cloves, and 1 oz. of glycerine.

No. 3.—4 oz. rye flour, ½ oz. of alum, 8 oz. water.

Rub to a smooth paste, pour into a pint of boiling water, heat until thick, and finally add 1 oz. of glycerine and 30 drops oil of cloves.

No. 4.—8 parts of dextrine, 10 parts of water, 2 parts of acetic acid.

Mix to a smooth paste, and add 2 parts of alcohol.

This compound is suitable for bottles and glass, and for wood, but not for iron, for which the first three are likewise adapted.

No. 5.—2 drm. starch, 1 oz. white sugar, 2 drm. gum arabic ; water.

Dissolve the gum, add the sugar, and boil until the starch is cooked.

No. 6.—Starch paste, with the addition of a little Venice turpentine mixed in while it is warm.

No. 7.—A good paste is made by soaking flake tragacanth in sufficient cold water that the brush will not sink into the paste when finished. To prevent souring, add to the water 2 drm. hydronaphthol, dissolved in a little alcohol, for each pint, and a few drops of clove oil for scent, taking away the flies. Add some oil of pennyroyal; avoid in making paste, oil of wintergreen and carbolic acid, for these produce a purplish discolourment by contact with the band of tinned iron round the brush.

Labels, Cement for (Buckland's Formula).

2 parts gum arabic, 1½ to 2 parts starch, ½ part sugar.

Reduce all the ingredients to a powder, and keep dry in bottles ready to mix up as wanted for use.

Labels, Glue for.

No. 1.—2 parts gelatine (best white), 1 part rock-candy, 3 parts water. Dissolve altogether.

No. 2.—4 oz. ordinary glue, 4½ oz. rock-candy, 1¾ oz. gum arabic, 1 pint soft or distilled water.

Dissolve all the solids in the water at a moderate heat.

Labels to Tinned Plates, Paste for.

No. 1.—Dissolve some isinglass in nitric acid, and brush the labels over with it. There will be no cause for complaint of their coming off, nor yet of striking through the paper. To prepare this, take a wide-mouthed bottle, fill about two-thirds with commercial acetic acid, and put in as much isinglass as the liquid will hold, and set aside in a warm place until completely dissolved. When cold it should form a jelly. To use it, place the bottle in hot water. The cork should be a well-fitting, sound one, and smeared with vaseline or melted paraffin.

No. 2.—Soften good glue in water, then boil it with strong vinegar, and thicken the liquid during boiling with fine wheat-flour, so that a paste results.

Labels on Machines, Paste for Fixing.

The following paste resists damp, and so prevents printed labels from falling off metallic surfaces.

Make into a paste good rye-flour and glue, and add to every pound thereof ½ oz. each of linseed-oil varnish and turpentine.

Labels on Metals, Paste for Fastening.

1 pint of water, 1 oz. borax, 5 oz. shellac.

Boil the whole until the latter is dissolved, thin with boiling water, if necessary; use hot.

Labels to Tin, Mucilage for Attaching.

No. 1.—4 parts shellac, 2 parts borax, 30 parts of water. Boil until the shellac is dissolved.

No. 2.—Add 1 part of dammar varnish to 4 parts of tragacanth mucilage.

No. 3.—1 part balsam of fir, 3 parts of turpentine.

This is used only for varnished labels.

No. 4.—To prepare the tin to receive the label, smear it with butter of antimony.

No. 5.—Venice turpentine added to good starch makes an excellent medium.

No. 6.—Use liquid glue, or glue dissolved in acetic acid.

No. 7.—Add 1 oz. of tartaric acid to each 16 oz. of flour acid in making flour paste.

No. 8.—Add 10 per cent. flour to gum arabic mucilage.

No. 9.—This cement is useful for vessels kept in a damp place.

1¼ part corrosive sublimate, 100 parts wheaten flour, 50 parts absinthe, 50 parts tansy, 1,500 parts water.

Make into a paste.

No. 10—10 parts starch, 5 parts strong glue, 5 parts turpentine; water.

Boil the whole in water. This cement dries quickly.

London Paste.

Mix equal parts of unslaked lime and caustic soda. Mix intimately, after reducing to a fine powder, in a warm mortar. Keep the latter in air-tight bottles, and mix up with water, as required, for use.

Maps, Paste for Mounting.

Stiff rye paste is the best to use. Stretch the cloth to apply the paste to the paper, and smooth it down upon the cloth, and allow it to dry before varnishing.

Mucilage.

No. 1.—The best quality of mucilage in the market is made by dissolving clean glue in equal volumes of water and strong vinegar, and adding quarter of an equal volume of alcohol and a small quantity of a solution of alum in water. The action of the vinegar is due to the acetic acid it contains. This prevents the glue from gelatising by cooling, but the same result may be accomplished by adding a small quantity of nitric acid. Several of the preparations offered for sale are merely boiled starch or flour mixed with nitric acid to prevent gelatising.

No. 2.—A strong aqueous solution of reasonably pure dextrine (British gum) forms a most adhesive and cheap mucilage. Alcohol or, rather, diluted wine spirits is usually employed as the solvent where the mucilage is to be used for gumming envelopes, postage stamps, &c.; and, in order to facilitate the drying, acetic acid is added to increase the mobility of the fluid. The strong aqueous solution is more adhesive than that prepared with alcohol, for the reason that it contains a greater proportion of the gum.

To prepare this add an excess of powdered dextrine to barley water, stir for a minute or two, allow to cool and settle, and strain the liquid through a fine cloth. The addition of a little powdered sugar increases the glossiness of the dried gum without interfering greatly with its adhesiveness. The sugar should be dissolved in the water before the dextrine is added.

No. 3.—Mix dextrine with hot water until a syrupy liquid is obtained, then add a few drops of oil of cloves, and cool for use.

—Caseine Mucilage.

Take the curd of skim-milk (carefully freed from cream or oil), wash it thoroughly, and dissolve it to saturation in a cold concentrated solution of borax.

This mucilage sticks well, and as regards adhesive power far surpasses the mucilage of gum arabic.

—Elastic Mucilage.

4½ parts glycerine, 4½ parts soft soap, 1½ part salicylic acid, 30 parts alcohol, 140 parts gum arabic, and 270 parts water.

Mix the gum with the water and let dissolve, and dissolve the other ingredients in the alcohol; then mix the two fluids.

--Mucilage of Gum Arabic.

To make a clean and almost odourless and permanent mucilage.

A German authority neutralises the free acid present in the gum with lime-water. Instead of water this authority uses a mixture of 20 per cent. lime-water and 80 per cent. distilled water.

Ordinary mucilage made from gum arabic does not fix paper to wood, or to pasteboard, or to metallic surfaces. These advantages are overcome by adding a solution of sulphate of aluminium, made up in ten times its quantity of water. 10 grains of aluminium sulphate (not alum) are sufficient for 250 grains of mucilage.

Again, according to Hierschberg, a few drops of strong sulphuric acid are added to the gum solution, and the precipitated sulphate of lime allowed to settle. Solutions prepared in this way neither became mouldy nor lost their adhesive power during eighteen months.

—Mucilage of Linseed.

1 oz. linseed, 6 oz. warm water.

Digest for six hours, stir, and then strain.

—Mucilage of Tragacanth.

1 drm. of powdered tragacanth, 6 drm. of glycerine, water enough to make 10 oz.

Put the tragacanth in a mortar with the glycerine, and then add the water. This will produce at once a mucilage of excellent quality.

—Mucilage to Adhere to Glass.

No. 1.—A strong mucilage capable of fastening wood or china and glass together is made of $3\frac{1}{2}$ oz. of strong gum arabic solution, to which a solution of 30 grs. of sulphate of aluminium dissolved in $\frac{2}{3}$ oz. water is added.

No. 2.—Put 1 or 2 drops of glycerine in a small bottle of mucilage; this will prevent the gum cracking in drying. Too much glycerine must not be added, as that would prevent the gum from hardening.

—Mucilage for Labels.

No. 1.—Dissolve 2 oz. of gum arabic in 2 oz. of water

soaked gelatine (best required), 30 drops of glycerine, and a lump of camphor.

No. 2.—Macerate 5 parts of good glue with 20 parts of water for a day, and to the liquid add 9 parts rock-candy and 3 parts gum arabic.

The mixture can be brushed upon paper while still luke-warm.

No. 3.—2 parts dextrine, 1 part acetic acid, 5 parts water, and 1 part alcohol.

No. 4.—2 parts gelatine, 1 part sugar-candy, 3 parts water.

—Mucilage for the Pocket.

Boil 1 lb. of the best white glue and strain very clean; boil also 4 oz. of isinglass, and mix the two together. Place them in a water bath with ½ lb. of white sugar, and evaporate till the liquid is quite thick, when it is to be poured into moulds, cut and dried for carrying in the pocket.

This mucilage dissolves immediately in water, and is useful for fastening paper, and is cleaner than paste to use.

—Mucilage for Postage-stamps.

Dissolve 2 parts dextrine in 5 parts water and 1 part acetic acid; try the acid by heat, and then add 1 part of 90 per cent. alcohol.

—Stick Mucilage.

Dissolve gum arabic in hot water to form a syrupy liquid, add a little clove oil and thicken with powdered gum dextrine.

Mould and dry slowly.

Pads, Paste for.

No. 1.—This composition is said to be prepared as follows:

4 lb. of glue, 2 lb. glycerine, ½ lb. linseed oil, 4 lb. sugar; aniline dyes sufficient to colour.

Soften the glue by soaking in a little cold water, then dissolve with the sugar in the glycerine by the aid of heat over a water bath, then add the dye, and stir in the oils. Use the paste hot.

No. 2.—4 lb. glue, ¼ lb. glycerine, 2 (about) tablespoonfuls of glucose syrup, $\frac{1}{10}$th oz. of tannin.

Give the composition an hour or two in which to dry or set before cutting or handling the pads.

Paper on Glass, Metal, and Wood, To Glue.

Mr. Eliel gives the following formula for a mixture which can be used for metal, glass, and wood :—

30 grm. gum tragacanth, 120 grm. gum acacia (gum arabic), 500 c.c. of water.

Dissolve, filter, and add 2½ grm. thymol suspended in 120 c.c. of glycerine ; then add enough water to make up the bulk to 1 litre (1¾ pint). These both will keep a long time.

Paper on Stone, To Fasten.

Melt together equal parts of asphalt and guttapercha ; use hot. Have the surfaces to be joined perfectly clean and dry.

Paper on Tinfoil, Paste for Fastening.

Make a paste by dissolving rye flour in a solution of caustic soda ; dilute with water, stirring all the time. Add to this paste Venetian turpentine—a few drops for each ½ lb. of flour.

This paste adheres firmly to all metals, tinfoil, glass, &c.

Paper on Wood, Leather, &c., To Cement.

2 parts shellac, 2 parts spirits of camphor, 6 to 8 parts of alcohol of 90 per cent. (*i.e.* methylated spirit will do when this strength of spirit is required).

Dissolve the shellac in the spirit of camphor, and then add the alcohol.

A superior cement is made by dissolving finely-scraped celluloid in alcohol of 90 per cent. strength.

Paper-bags, Paste for Manufacture of.

Add to 3 parts of the best starch 24 to 30 parts of cold water. Stir together to a homogeneous mass of about the thickness of syrup. Pour over this, with constant stirring, boiling water until the paste is of the required consistency. Stir until nearly cold. Take a portion of the paste and add to it 6 to 15 per cent. liquefied Venice turpentine ; rub together until a kind of emulsion is formed, then mix the whole together and work thoroughly.

Paperhangers, Paste for.

No. 1.—The best paperhangers' paste, as well as a paste for general purposes, is simply wheat or rye flour beaten in cold water to perfect smoothness, and the whole just brought

to a boil, while being constantly stirred to prevent burning. A little creosote or carbolic acid will keep it much better. Any addition to this paste fails to improve it.

No. 2.—Take ½ quartern of flour (best biscuit) and put it into a pail with a small portion of alum beat up small. Mix it up into a stiff batter with warm water; have ready a large saucepan of boiling water, and pour it on the paste, stirring well all the time, or it will be lumpy. If properly done, it will thicken as the boiling water is poured over it. If it does not thicken, set it over the fire a few minutes, but be sure to keep stirring it, else it will burn. When well thickened, throw a dash of cold water over it, as it prevents it skinning. Use rather thin. It can be thinned with cold water.

Parchment Glue.

Dissolve hogskin parchment shavings (but not those of sheepskin parchment), and boil the solution to half its volume.

Used by bookbinders.

Parchment Paper, To Cement.

Mix ordinary glue with about 3 per cent. of bichromate of potassium in the dark. This may be used on the paper, and, after exposure to light, becomes perfectly insoluble in boiling water.

This glue has been largely used in Germany for joining the parchment-paper envelopes of pea-sausages. The strips of paper joined by this glue are dried quickly, and exposed to light till the glue changes to a brownish colour. They are then boiled with water containing 3 per cent. of alum till all the excess of the alkaline bichromate is extracted, and then washed in water and dried.

Paste for Matrix, to take Casts from.

Dissolve 2 oz. of finest gelatine in vinegar, then add to this 1 oz. alum and 1 quart of hot water. In a separate vessel dissolve 1 lb. of starch in cold water, never bringing the water in which is boiled the gelatine and alum to boiling point, and gradually stir in the dissolved starch, stirring all the time to prevent lumps. Boil half an hour, stirring all the time. When cold, to 1 pint of paste add water and 1 oz. of Spanish-white. To make matrix use enough water to the paste so as to spread well.

Pasting and Soldering Machines, Paste for.

Soften 4 parts by weight of glue in 15 parts of cold water for some hours, and then moderately heat until the solution becomes quite clear. Then add 65 parts of boiling water, with constant stirring. In a second vessel stir up 30 parts of starch paste in 20 parts of cold water, so that a thin, milky fluid is obtained without lumps. Pour the boiling solution of glue into this mixture, and heat the whole at the boiling temperature. To preserve the paste, add 10 drops of carbolic acid when cooled off. Keep the parts well covered over a jar or other suitable vessel so as to prevent loss of water by evaporation.

Leather, cardboard, as well as paper may be united to any articles by this paste.

Photographers, Pastes for the Use of.

[The following collection of recipes for pastes for mounting purposes was given in the *Photographic Times* by Mr. W. H. Gardner.]

No. 1. *Gelatine Mountant.*—1 oz. cooling gelatine, 10 oz. alcohol (95 per cent.), ½ to 1 oz. glycerine.

The gelatine is soaked in water for an hour, then taken out and drained, and put into the alcohol in a wide-mouthed bottle, and add the gelatine in proportion to make the mixture hard or soft, and put the bottle in a water bath, shaking occasionally the contents until the gelatine is quite dissolved. For use, heat by standing in hot water.

No. 2.—4 oz. Nelson's photographers' gelatine, 16 oz. water, 1 oz. glycerine, 5 oz. alcohol.

Dissolve the gelatine in the water, then add the glycerine, and, lastly, the alcohol.

No. 3.—Soak 1 part of gelatine in 10 parts of water. Mix 10 parts of ammonia with a small quantity of the water, put that into the gelatine solution, and boil all together for four or five minutes. After cooling, add 10 parts of carbolic acid or oil of cloves.

No. 4.—This is another formula for the same article.

1¾ oz. best Bermuda arrowroot, 80 gr. sheet gelatine or best Russian glue, 1 oz. methylated spirit.

Put the arrowroot into a small pan, add 1 oz. water, and mix it up thoroughly with a spoon or the ordinary mounting-brush

until it is like thick cream; then add 14 oz. water, and the gelatine broken into small fragments. But for four or five minutes set it aside until partially cold, then add the methylated spirit and 6 drops of pure carbolic acid. Be very careful to add the spirit in a gentle stream, stirring rapidly all the time. Keep it in a covered stockbottle, and take out as much as may be required for the time, and work it up nicely with the brush.

No. 5. *Starch Paste.*—Pour cold water on laundry starch to barely moisten it, then stir in cold water until proper consistency is reached. Squeeze through canvas if not free from lumps.

Starch paste should be freshly made for each batch of prints.

No. 6. *Caseine Mucilage.*—Separate the caseine from milk by means of a little tartaric acid, and treat the caseine while still warm with a solution of 6 parts borax to 100 parts water, and warm gently while stirring, which will cause the caseine to be dissolved. Of the borax solution enough should be used to leave only a little undissolved caseine behind.

No. 7. *Good Mounting Paste.*—Add to 250 c.c. (*i.e.* cubic centimètres) concentrated gum solution (2 parts gum to 5 parts water) a solution of 1 grm. sulphate of alumina in 20 c.c. water. Alum does not answer the purpose as well. The addition of the sulphate is effective in that this gum is not so readily affected, and, besides, wood can be fastened to wood by means of it. Its adhesive qualities are, in general, greater than those of pure gum arabic.

No. 8. *Impervious Paste.*—Soak ordinary glue in water until it softens; remove it before it has lost its original shape, and dissolve in ordinary linseed oil on a gentle fire until it is of the consistency of jelly.

This paste may now be used for all kinds of substances, as, besides great strength and hardness, it possesses also the advantage of resisting the action of water.

No. 9. *Liquid Glue.*—With any desired quantity use ordinary whisky instead of water. Break the glue into small fragments, and introduce these into suitable glass vessels, and pour the whisky over them. Cork tightly, and set aside for three or four days, when it will be ready for use. The whisky must not be too strong, and a little heat is generally required.

Remarks.—The first five recipes are quite safe for silver prints if good materials are used, and do not become decomposed subsequently.

Gelatinous mountants made with a considerable proportion of alcohol, like No. 1 and No. 9, have the advantage of not considerably stretching either mount or print, and are especially useful when prints (whether silver or Woodburytypes) have to be mounted on thin card.

In the case of Nos. 2, 3, and 4, the alcohol is used mainly as an antiseptic, and is not present in sufficient quantity to have much influence as a preservative by stretching or cockling.

The simple starch-paste is not satisfactory in all cases, owing to want of sufficient adhesion, in which case it is an excellent plan to adopt a paste in which starch and gelatine are used together.

No. 8 is quite unfit for mounting silver prints, although it may be useful for other work in the studio which is likely to be exposed to damp; for example—strips of cloth used to make the developing-room light-tight may well be cemented with this cement, especially if 11 gr. finely-powdered bichromate of potash be stirred in it each time just before use.

The desirability of employing caseine mucilage and No. 7 as mountants for silver prints is open to doubt, although these are excellent for cementing all such ordinary materials as come under the denomination of stationery.

The following has been suggested as a very desirable substitute for the ordinary pastes, and mainly for photo prints. It is said that it can be used so as to scarcely swell the paper at all, avoiding the objectionable cockling so much complained of.

16 oz. thick, well-boiled, clean starch paste, 7 oz. glucose syrup ("a" clear), ½ oz. white curd soap, 5 oz. dextrine (flowered), ⅛ oz. borax, clove oil (a few drops).

All are heated over the water bath, and skimmed down to a proper consistency (if thin paste is required) with fresh skimmed milk. It is advisable to use the paste warm, and as thick as possible.

Postage-stamps in United States, Paste Used for.

2 parts dextrine, 1 part acetic acid, 5 parts water, 1 part alcohol.

Mix all together.

Post-office Packages, Safety Paste or Cement for.

It is well known that postal wrappers and envelopes can be opened, the adhesive and stamps detached, by moistening them with the steam from a kettle. The following composition, however, will frustrate any such dishonest practices. Two adhesive compounds are used, one being applied to the flap of the envelope or wrapper, and the other to the part against which it is pressed, or the first to the stamp and the other to the place where it is to be affixed.

(1.) *Upon the Letter.*—2½ parts chromic acid, 15 parts caustic ammonia, 15 parts water, ½ part sulphuric acid, 30 parts cupro-ammonia solution, 4 parts fine white paper.

(2.) *Upon the Flap or Stamp.*—Dissolve isinglass or glue in a mixture of 7 parts water and 1 part acetic acid. The chromic acid forms with glue a combination insoluble in water.

When the parts of the wrapper, envelope, &c., are fastened together, the union is so firm as to resist all loosening influences, acids, alcohol, hot or cold water, or steam. The wrapper can only be opened by tearing or cutting.

The following is the precise formula, as given by the inventor:—

The cement consists of a chromium preparation and isinglass. The one material is put on the envelope covered by the flap (and is therefore not touched by the tongue), while the isinglass dissolved in acetic acid is applied under the flap. The chromium preparation is made by dissolving crystallised chromic acid in water.

Take 25 grm. crystallised chromic acid, 15 grm. water, 15 grm. ammonia. To this solution add 10 drops of sulphuric acid, and 30 grm. sulphate of ammonia, and 4 grm. of fine white paper.

In the case of envelopes this is applied to that portion lying under the flap, while a solution prepared by dissolving isinglass in dilute acetic acid (1 part acid to 7 parts water) is applied to the flap of the envelope. The latter is moistened, and then is pressed down upon the chromic preparation, when the two unite, forming a firm and insoluble cement.

Scrapbooks, Paste for.

1 oz. rice starch, 3 drm. gelatine, ½ pint water.

Heat, with constant stirring, until the milky fluid becomes thick and gluey; when the paste is nearly thick put it in a bottle closely corked, with a few drops of oil of cloves.

Skins, Glue or Paste for.

Put 1 lb. of rye flour into a basin and pour enough boiling water in it to make a stiff paste. It must be made as stiff almost as ordinary dough for puddings, but not quite. Stir and beat up well with a stick for three or four minutes, then cover up and put by for two days before using, when it will be much softer and stick better. Spread thinly and evenly on back of skin with a stiff brush or pad; this will stick firmly, and will not crush.

Stickphast Paste.

1 oz. wheaten flour, ½ oz. powdered tragacanth, ½ oz. powdered gum arabic, 30 salicylic acid, 3 drops oil of turpentine, 12 oz. water.

Mix the powders and gradually add the water, then bring to the boil; allow to simmer for twenty minutes, stirring constantly. When cold add the oil.

Tablets, Glue for.

Take 50 parts of the best glue (dry), soak it for ten minutes, then heat it until dissolved, and add 9 parts of glycerine. If too thick, thin with water; colour with aniline.

Wafers.

These adhesives have ceased to be employed for fastening letters, having been superseded by gummed envelopes, but they are still used for some purposes, and as they are simple to make we give the following recipes:—

The tools required are very simple, consisting of a kind of waffle iron—*i.e.* two plates of iron which come together like pincers, leaving a small space between them—and annular punches of different sizes with sharp edges to cut the prepared paste into wafers.

The material used in making wafers is either gelatine or wheat flour and water.

No. 1. *White Flour Wafers.*—Mix fine wheat flour with water to a smooth pap. Pass the mixture through a sieve to remove any clots or lumps. Fill the wafer irons (previously warmed, and greased with butter or olive oil) with the batter, close them tight and expose them for a short time to the heat of a clear charcoal fire. The whole must then be allowed to cool, when the irons must be opened and the thin cake, which is now hard and brittle, must be cut into wafers by means of sharp annular steel punches.

No. 2. *Gelatine Wafers, Glue Wafers, Transparent Wafers.*—Dissolve isinglass in the best glue in sufficient water to form a consistent mass when cold; pour it while hot upon the surface of a warm plate of mirror glass, slightly oiled and surrounded with a border of cardboard, laid flat; next apply a similar plate, also warmed and oiled, and press the two into as close contact as is permitted by the card-paper. When cold, the thin coat of gelatine must be removed, and cut into wafers with punches, as before.

No. 3. *Coloured Wafers.*—These are made in a similar manner to white wafers. The flour need not be the purest white, but the colouring matter which is mixed with the wafer paste must be readily soluble in water, and devoid of any unpleasant taste or of injurious effects. Most metallic salts or oxides, and some of the vegetable colouring substances must be avoided, as the wafer is usually wetted with the tongue. If the colouring matter cannot be dissolved in water, it must be converted into an impalpable powder.

No. 4.—*Black Flour Wafers* may be produced by adding some finely pulverised lampblack or Chinese to the dough.

No. 5.—*Blue Wafers* are obtained by colouring the dough with finely pulverised Berlin blue, or a blue liquor obtained by adding a few drops of a solution of sulphate of iron to one of ferrocyanide of iron (Prussian blue). Soluble Prussian blue must not be used, as this is prepared with oxalic acid, which is a deadly poison even in small quantities.

No. 6.—*Red and Rose Colour Flour Wafers* may be made by colouring the dough more or less with a concentrated decoction of madder or Brazil wood; but a more lively colour is produced by using an infusion of finely-powdered cochineal, brightened with some alum.

No. 7.—*Violet Flour Wafers* are prepared by adding a mixture of red and blue to the dough.

No. 8.—*Yellow Flour Wafers.*—A decoction of weld (dyer's weed), turmeric, or saffron is used for colouring the flour paste with.

No. 9. *Gelatine or French Wafers.*—Dissolve fine glue by itself, or mixed with isinglass, in water to a suitable consistency. Pour it upon a glass plate previously warmed with steam and slightly greased, which is fitted in a metallic frame with edges just as high as the wafers are to be thick. Then lay a second plate of glass, heated and greased on the surface so as to touch every part of the gelatine, and resting on the edges of the frames. When the two plates of glass get cold the gelatine congeals and may readily be removed. The layer so formed is then cut with proper punches of different sizes into wafers. The colouring matter is added to the boiled gelatine, and should be non-poisonous.

No. 10. *Light Red Wafers.*—Mix the boiled gelatine with fine English minium (redlead) rubbed up in whisky.

For medium red use Chinese cinnabar rubbed up in whisky.

For all dark colours the amount of colouring matter needed can only be determined by experiment, as when too little is taken the colour is not sufficiently intense, and if too much, the wafers lose their lustre and adhesiveness.

No. 11 —For *Transparent Red Wafers* use a decoction of Brazil-wood brightened with some alum.

No. 12.—*Blue Gelatine Wafers* are produced by using sulphate of indigo saturated with potash (*i.e.* indigo carmine), while this preparation mixed with yellow is used for producing greens.

No. 13.—For *Yellow Gelatine Wafers*, an infusion of saffron or turmeric gives the best results, but a decoction of weld, fustic, or Persian berries can be used.

Instead of an aqueous decoction of these dyeing materials an alcoholic tincture gives more brilliant colours, and the small addition of the spirit gives greater adhesiveness to the gelatine.

—**Metallic Wafers.**

These consist of very thin leaf metal, glossy on the surface, and on the lower side provided with a sticky substance. The leaves are passed between two rollers, one having a smooth, and the other a somewhat rough surface. To the latter the following mixture is applied :—

16 parts glue, 4 parts gum arabic, 5 parts syrup, 3 parts spirits of wine, 1 part camphor, 1 part virgin wax, 12 parts water.

The mixture is prepared by placing these ingredients in a glass flask hermetically closed and heated for eight hours in a sand bath at a temperature of 210° F. The solution is then filtered and diluted with 1 part of alum in 15 parts of water, keeping the temperature somewhat below the boiling point. When dry the prepared leaves are cut with proper punches into wafers of different sizes. The smooth surface may be gilded or lacquered.

Wall-paper, Paste for.

100 parts flour paste, 3 parts alum water (alum dissolved in water until no more can be dissolved), 5 parts solution of dextrine.

Stir the alum and dextrine solutions into the flour paste; the dextrine increases the adhesive power, the alum solution prevents it from spoiling and also prevents the wall-paper becoming mouldy or at all damp.

Wood, Ivory, Jewellery, and all Fancy Work, Paste for.

4 oz. orange shellac broken small, 3 oz. rectified spirit (the strongest, 58 per cent.).

Digest together in a corked bottle in a warm place until dissolved. It should have the consistence of molasses.

X. MISCELLANEOUS RECIPES

Alabaster, Cements to Mend.

No. 1.—2 gills vinegar, 2 gills skimmed milk, 5 eggs' white, quicklime.

Curdle the milk with the vinegar, and then mix in the whites of eggs, well beaten up beforehand, and then sift in enough quicklime in powder to form a paste, with constant stirring.

No. 2.—1 part plaster of Paris, 1 part yellow resin, 1 part beeswax.

Melt the resin and wax, and then mix all together.

No. 3.—Rice glue, thickened with powdered quicklime.

No. 4.—2 parts yellow resin (colophony), 1 part plaster of Paris, 8 parts common resin. Also 1 part wax, plaster of Paris.

Melt the colophony, and stir in the 1 part plaster of Paris; separately melt the common resin and wax, and stir in sufficient plaster of Paris to make thin paste, and then mix the two compounds by melting and stirring.

No. 5.—1 part plaster of Paris, 2 parts yellow resin.

Melt the resin, stir in the plaster of Paris, and apply hot, warming the faces of the fracture or joint.

No. 6.—Melt sulphur with plaster of Paris, or else use plaster of Paris alone.

Alloy for taking Impressions of Coins, Medals, Woodcuts, &c.

Melt at as moderate a heat as possible 4 parts of bismuth, 2½ parts of lead, 2 parts of tin, and 19 parts of worn-out metal type.

Almond Paste for Luting (where the dead heat does not exceed 320° F.)

Take ground almond cake from which oil has been expressed, and mix it with whiting and water into a paste. Equal parts of the two ingredients should be used.

Amber, Cements for.

No. 1.—Heat the surface, dip in boiled linseed oil or melted shellac, and then clamp the pieces together firmly until set.

No. 2.—Melt mastic resin in linseed oil. Use hot.

No. 3.—Moisten the surfaces with solution of potash, and then press them together.

Aquaria, Cements for.

No. 1.—Take equal parts of flour of sulphur, pulverised sal ammoniac and iron filings, and mix into a paste with linseed-oil varnish. Then add enough whitelead to form a firm, easily worked mass.

No. 2.—8 parts whiting, 3 parts plaster of Paris, 3 parts white beach-sand, 3 parts litharge, 1 part powdered resin.

Mix all the ingredients in the dry state, and then make into a putty with the best coach varnish.

After cementing the glass in the framework, leave it awhile before putting water in it.

No. 3. *Elastic Non-poisonous Cement for Aquaria.*—3 parts linseed oil, 4 parts tar, 16 parts resin.

Melt all together over a gentle heat.

If too much oil is used the cement will run down the angles of the aquaria; to prevent this it should be tested before using by allowing a small quantity to cool under water. If not found sufficiently firm allow it to simmer longer, or add more tar and resin. The cement should be poured in the corners of the aquarium while warm, not hot.

No. 4.—10 parts (by measure) of litharge, 10 parts plaster of Paris, 1 part finely-powdered resin, 10 parts dry white sand, boiled linseed oil.

Mix all together in the dry state, and make into a stiff putty with the oil when wanted for use.

Do not use the tank for three days after cementing. This cement hardens under water, and will stick to wood, stone, metal, or glass, and, as it resists the action of sea-water, it

is useful for marine aquaria. The linseed oil may have an addition of drier to the putty made up four or five hours before use, but after standing fifteen hours, however, it loses its strength when in the mass.

No. 5.—2¼ parts litharge, 2¼ parts fine white sand, 2¼ parts plaster of Paris, 1 part boiled linseed oil.

Mix all together into a paste, and then thin with drying oil; let the cement stand for a few hours before using. It becomes very hard, but acquires its greatest hardness when under salt water; hence it is especially applicable for fresh or salt water tanks, &c.

No. 6.—Take 8 oz. of a solution of glue, 1 oz. of Venice turpentine, and boil together, well stirring all the time till the mixture is complete. The joins to be cemented should be kept in close contact for a couple of days.

Architects and Draughtsmen, Modelling Paste for.

Boil white paper in water for five hours, then pour off the water and pound the pulp in a mortar, pour it through a sieve, and mix with some gum-water or isinglass glue. You then have an excellent compound for use in modelling.

Bicycle Tyres, &c., Cements for Cuts in.

No. 1.—10 oz. bisulphide of carbon, 20 oz. caoutchouc, 10 oz. guttapercha, 5 oz. fish glue.

To use, dissolve the last three ingredients in the first; bind the tyre well with cord until set.

No. 2.—2 parts pitch, 1 part guttapercha.

Melt together and use hot.

Bone, White Cement for.

If only to fill up cracks, try lime and white of egg made up into a paste, or ground rice flour mixed with water.

Bone and Horn, Cement for.

Dissolve 5 parts of mastic resin and 2 parts of turpentine in 6 parts of linseed oil. The resin requires some time to digest thoroughly, and when it is, give a vigorous shaking to the whole.

Bone and Ivory, Glue for.

Boil isinglass in water until very thick, and then add enough oxide of zinc to make the whole the consistency of molasses.

Bone and Ivory, Cement for.

White wax, resin, oil of turpentine; colouring matter, as redlead, ultramarine, &c.

Melt the wax, resin, and turpentine together in a gallipot or earthenware pipkin at a moderate heat, so as to form a thick fluid mass; then stir in the colouring body.

Cards, Cement for Enamelling.

For white and for all pale and delicate tones, take 24 parts by weight of paraffin (solid), fuse it to the melting point, and then add 100 parts of pure china clay in a very dry condition. Allow the mixture to cool and it will form a homogeneous mass, which for use is reduced to powder and worked into paste in a paint mill with warm water. This compound can be tinted according to fancy.

Chinese Cement.

No. 1.—Digest 1 part of shellac in 2 oz. alcohol placed in a corked bottle. Stand in a vessel of warm water.

No. 2.—1 part borax, 2 parts water, 3 parts shellac.
Evaporate to the required consistence.

No. 3.—To 3 parts of freshly-beaten bullock's blood are added 4 parts of slaked lime and a little alum. A thin pasty mass is produced, which can be used immediately.*

Clock-faces, Cement for White Enamelled.

50 parts dammar resin, 50 parts copal, 55 parts Venice turpentine, 30 parts zinc-white, 1 to 2 parts ultramarine.

Mix the varnish by heat in the water bath; then stir in the pigment. Apply hot, and polish when cold.

* Objects which are to be made specially waterproof are painted by the Chinese twice, or, at the most, three times. Dr. Scherzer saw in Pekin a wooden box which had travelled the tedious road *vid* Siberia to St. Petersburg and back, which was found to be perfectly sound and waterproof. Even barrels made of straw become by the use of this cement perfectly serviceable for the transporting of oil. Pasteboard treated therewith receives the appearance and strength of wood. This cement was tried in the Austrian Department of Agriculture, and by the Vienna Association of Industry, and in both cases the statements of Dr. Scherzer were found to be strictly accurate.

Cloth, Cement for.

8 parts guttapercha, 2 parts caoutchine, 1 part pitch, ½ part shellac, 1 pint linseed oil.

Dissolve the whole together by heat and constant stirring.

Cloth or Leather, Cement for.

16 parts guttapercha, 4 parts indiarubber, 2 parts pitch, 1 part shellac, 2 parts linseed oil, all cut up small and melted together, being well stirred.

Coignet Beton.

5 measures of sand, 1 measure of quicklime, ¼ to ½ measure of hydraulic cement.

Mix well in the dry state, and make into a mortar with water as wanted.

Collodion Cement.

1 drm. powdered nitrate of potash (saltpetre or nitre), 1½ drm. concentrated sulphuric acid, 5 gr. carded cotton.

Mix the acid and potash salt in a glass beaker or porcelain evaporating-dish, gradually push in the cotton, and stir for five minutes, wash it thoroughly in clean water, pull it apart, and dry—not near the fire, as it is a species of gun-cotton, but in slabs in the open air. Dissolve it in rectified sulphuric ether and a little alcohol. It forms a transparent, colourless, and strong cement.

Cork, Cement for.

No. 1.—Use zinc-white rubbed up with copal varnish to fill up the tissues when dry. This should be covered with the same mass, somewhat thinner, and lastly with copal varnish.

No. 2.—Plain shellac varnish will often answer the purpose.

No. 3.—Corks boiled in paraffin resist the action of the atmosphere; also worms and insects.

No. 4.—To resist acid fumes, the corks should be well covered with paraffin-wax, by dipping them several times in a bath of melted wax.

No. 5.—To corks that are to be used for bottles containing liquids not of a spirituous nature, sealing-wax varnish may be used. This is made by digesting best sealing-wax in methylated spirits.

Corkstone.

A product possessing many of the properties of natural cork, with less specific gravity, is prepared as follows:—

6·3 parts by weight of pulverised corkwood are mixed with boiling paste, prepared from 3 parts by weight of starch, and 25 parts of boiling water. The plaster mass thus obtained is pressed at once into suitable moulds, and the objects produced are dried at a temperature of 212° F. The drying process is very slow. To make the articles more capable of resisting moisture, add small quantities of linseed oil or tar to the mass. Corkstone thus prepared being very light, and a poor conductor of heat, is especially adapted as a building material for the insulation of roofs, for ice-cellars, and drying-rooms.

Dental Cements.

No. 1.—A cement or mastic may be prepared by mixing 1 part of finest pulverised glass with 3 parts of oxide of zinc thoroughly calcined (made from the carbonate), which is afterwards kept in well-stoppered bottles; 1 part of borax is also dissolved in the smallest possible quantity of water, and mixed with a solution of chloride of zinc, 15 to 16 sp. gr., and so kept in small, well-corked bottles.

To use the cement, enough of the powder is mixed with some of the liquid to form a putty, which hardens readily like stone. A similar preparation to this is sold under the name of "Paris Dental Cement," for filling hollow teeth. The composition can be used for many other purposes where a tenacious, quick-binding cement is required.

No. 2.—The cement most generally in use for ordinary plugging is composed of 5 parts of oxide of zinc, 2 parts silex, 1 part borax, moistened with a solution of 1 oz. zinc chloride in 6 drm. water. Where it is to be used as a capping or temporary filling over freshly exposed pulps, the fluid to mix the above ingredients with should be 1 oz. zinc chloride to 1 to 2 oz. water, not stronger in zinc chloride, as that substance is a violent poison.

Having cleaned the cavity of the tooth, apply creosote to the exposed part, and then introduce the above cement in a semi-fluid state, and put over it a rubber stopping until the cement has properly hardened; half an hour usually suffices.

No. 3. *Phosphate Cement.*—This cement can only be made successfully by a chemist or dentist. It is prepared by concentrating pure phosphoric acid till semi-solid, and mixing aluminium phosphate with it by heating.

To use, mix these compounds with basic oxide of zinc to the consistency of putty. The light oxide of zinc should not be used in this cement, nor in making oxychlorides. This cement sets in ten minutes.

No. 4.—By calcining magnesium nitrate an oxide is made; this, when hydrated, forms a suitable cement. When mixed with phosphoric acid it hardens at once, growing so hot as to burn the hand. As basic oxide of zinc forms with phosphoric acid a slow-setting cement, the indication is plain.

No. 5. One authority uses for pulp capping and temporary filling the following mixture:—

2 parts basic oxide of zinc, 5 parts oxide of manganese; grind them together.

For use, mix to a paste with syrupy phosphoric acid. This sets in thirty seconds.

No. 6. *Guttapercha Stopping.*—This well-known stopping is pure, uncoloured, native guttapercha. A small piece is softened in hot water, and at once applied. It answers well for filling hollow with central cavities, and is efficient and durable.

No. 7. *Vienna Cement.*—This cement is neither hard nor durable; it is powdered asbestos made into a paste with thick mastic varnish.

No. 8. *Worth's Cement.*—This is levigated quartz made into a paste with very thick mastic varnish. The colour is good, but it is not very durable.

No. 9. *Mr. Evans's Formula.*—Take of pure grain tin 2 parts, cadmium 1 part, beeswax 1 part.

Melt them together in a porcelain crucible at a heat not exceeding 600° F., and cast the alloy, so as to form a small ingot, which when cold must be reduced to filings.

For use, a small quantity of the filings is formed into an amalgam with quicksilver, the excess of the latter is squeezed out through a piece of chamois leather, and the amalgam at once applied to the tooth. This cement is recommended by

Mr. Evans as very durable and unobjectionable. Its colour is intermediate between that of silver and tin, but it is said not to darken so readily as the amalgam of those metals.

No. 10. *Dentists' Zinc Amalgam.*—This is pure zinc filings, combined with twice their weight of quicksilver, a gentle heat being employed to render the union more complete. It is best applied as soon as made. Colour gray. Often proves effective and durable.

No. 11. *Poudre Metallique.*—According to an authority the article sold in Paris under this name is a triple amalgam of mercury, silver, and ammonium, with the latter in excess.

No. 12. *Silica Cement.*—A mixture of levigated porcelain, plaster of Paris, and steel filings, in equal proportions, made into a paste with thick, quick-drying copal varnish. It is only adapted to fill central cavities in the double teeth, as its colour unfits it for the front ones.

No. 13. *Taveare's Cement.*—This is powdered mastic, mixed with about half its weight of ether, and then with sufficient powdered burnt alum to form a stiff putty. It must be kept in a closely-stoppered bottle. It has little hardness and durability.

—Zinc Cements for Filling Teeth.

No. 1.—200 parts zinc oxide, 8 parts silica, 4 parts borax, 5 parts powdered glass.

No. 2.—500 parts oxide of zinc, 1½ part powdered amber, 1½ part yellow ochre, 10 parts borax, 100 parts powdered glass.

No. 3.—500 parts zinc oxide, 1½ part powdered pyrolusite (sesquioxide of manganese), 3½ to 4 parts yellow ochre, 100 parts powdered glass, 10 parts borax.

Mix well all the powders, sifting them through a hair sieve, and preserve in well-corked bottles. Nos. 1 and 2 give light-coloured cements; No. 3, when the larger proportion of yellow ochre is used, gives the darkest colour.

When any of the cement is to be used, mix it with concentrated solution of zinc chloride (a deadly poison) to form a paste, and fill the hollow tooth with it. In ten minutes the paste becomes hard, and remains unchanged for years.

—Dentistry, Alloys or Cement for Use in.

	Tin.	Silver.	Copper.	Gold.	Mercury.
No. 1.—	93·63	3·82	4·4		
No. 2.—	36·78	48·32		14·72	
No. 3.—	51·72	34·35			8·52

—Robinson's Alloy for Filling Teeth.

1 part gold, 3 parts silver, and 2 parts tin.

First melt the gold and silver in a crucible, and at the moment of fusion add the tin; when the alloy is cold, pound it up and sift it. Then for use pound equal parts of the powder and mercury in the palm of the hand, sufficient to form a pellet to squeeze into the hollow tooth to be filled.

—Notes on the Use of Cements for Teeth.

One of the most important parts to attend to in filling or stopping teeth is that each tooth must be thoroughly cleaned out and wiped perfectly dry before inserting or applying the cement, of whatever kind it may be. Without careful attention to this matter, the cement will not adhere, or will soon become loose and drop out or off, and the operation prove a failure. When a defective tooth is conveniently situated, it may often be filled by the patient himself, by the exercise of a little skill and care, particularly if it be a hollow one with a clearly defined central cavity. When the reverse is the case, it is generally necessary that the operator should be a second person.

Flexible Cement.

Melt over a water bath equal parts of white pitch and gutta-percha. Guttapercha and rubber cements are nearly all flexible.

German Tree Wax.

This preparation is placed over bruised parts in tree branches, and to prevent them decaying.

3 parts finely powdered lime, 1 part finely powdered charcoal, linseed oil.

Make into a dough, and keep in a jar or pot hermetically sealed. Apply to the required parts by means of a brush.

Glycerine Cement.

This cement is adapted for vessels containing benzole, ether, oils, acids, &c., also for iron and stone.

Moisten litharge with glycerine; the product is a cement which dries very hard in ten minutes.

Hard Cement.

8 parts dried and powdered clay, 4 parts clean iron filings, 2 parts peroxide of manganese, 1 part sea salt, and reduce to paste with water. Use immediately, and heat the articles after cementing the fractured parts.

Hard Rubber, Cement for Mending.

Fuse together equal parts of guttapercha and genuine asphaltum.

Apply hot to the joint, closing the latter immediately with pressure.

Heat-proof and Acid-proof Cement.

100 parts sulphur, 2 parts tallow, 2 parts resin.

Melt all the ingredients together to a ruddy syrup, add sifted ground glass to form a paste, and heat when used.

Hensler's Cement.

This cement requires a very long time to set, although it is very tenacious.

6 parts litharge, 4 parts quicklime, 2 parts white bole, linseed oil.

Grind up the ingredients in the oil.

Hoenle's Cement.

2 parts shellac, 1 part Venice turpentine.

Melt and mould into sticks.

Holes in Wood, Cement to Fill.

1 part resin, 1 part turpentine, 2 parts common burnt ochre.

Mix by heat of a water bath, and have the wood dry before using the cement.

Horn, To Cement.

Heat the pieces of horn before a fire, and carefully scrape the edges where they are to be joined until they fit together exactly. Then take a pair of pincers, previously heated quite hot, and, after moistening the object to be joined, press them together firmly and quickly. If the operation is skilfully performed a perfect joint will result, and after the edges have been made smooth with a fine file and polished with tripoli and water, it will be difficult to tell where the join is.

Horses' Hoofs, Cement for.

2 parts guttapercha, 1 part gum ammoniac.

Heat the guttapercha and add the gum ammoniac gradually; this ingredient should be very finely powdered. Heat the cement for use.

—Guttapercha Cement for Horses' Hoofs.

To fill cracks and fissures in the hoofs of horses a cement is required which resists the action of water and possesses great elasticity combined with solidity. The following compound meets all requirements.

10 parts, by weight, of gum ammoniac, 20 to 25 purified guttapercha.

Heat the guttapercha from 195° F. to 212° F., and, having powdered the gum, knead it until a homogeneous mass is formed.

Throughly cleanse the place to be cemented, heat the cement until it becomes soft, and place it into the cracks in the hoof by means of a heated knife.

The cement becomes hard when cooled off to the ordinary temperature, and acquires in a short time a degree of solidity that nails may be driven into it.

Hot-air Pipes, Cement for.

6 parts (by measurement) chalk, 2 parts limestone or lime, 2 parts salt, 1 part sand, 5 parts iron filings, 5 parts red or blue clay.

Hot-water Cisterns, Cement for.

4 to 5 parts of clay, dried and pulverised, 2 parts fine iron filings free from oxide, 1 part peroxide of manganese, ½ part sea-salt, and ½ part borax.

Thoroughly incorporate all the above in as fine a state as possible, reduce them to a thick paste with water, and use immediately. It should then be exposed to a heat gradually increasing to almost a white heat.

This cement resists heat and boiling water.

Impervious Cement.

Use zinc oxide, rubbed up with copal varnish.

Indianite Cement.

No. 1.—This cement is used for uniting indiarubber.

20 parts finely chopped rubber, 3 parts resin, 2 parts shellac, bisulphide of carbon.

Dissolve the ingredients in a sufficient quantity of the fluid ingredient.

No. 2.—15 gr. indiarubber, 2 oz. chloroform, ½ oz. mastic resin in powder.

Mix the first two ingredients, and then put in the mastic after the rubber has dissolved. Allow the mixture to remain for a week or so for the resin to slowly digest. This is very inflammable, so do not bring it near a naked flame.

Ivory, Cements for.

No. 1.—Dissolve 1 part of isinglass and 2 parts of white glue in 30 parts of water, strain and evaporate to 6 parts; add $\frac{1}{10}$ part of mastic resin dissolved in ½ part of alcohol and 1 part of zinc-white. When required for use, warm and shake up.

No. 2.—Moisten thoroughly a small quantity of very finely-powdered quicklime with white of egg to form a paste. Use at once. Clamp the parts firmly together, and leave for twenty-four hours. Use as little of the cement as possible.

Jannin's Cement.

This is known as Jannin's Cement, from the name of the patentee, a resident of Paris. The cement is simply a mixture in suitable proportions of yellow oxide of lead (the quality known as massicot being preferable) with glycerine. Several other metallic oxides and matters may be mixed with the cement, so as to suit the quality of the colour of the cement to the nature of the work to be produced, but the essential compounds are yellow oxide of lead and glycerine. The proportions of the oxide of lead and glycerine vary according to the consistency of the cement it is desired to produce. The proportion of glycerine will, of course, be larger for a very soft cement than a stiff cement. It is not necessary, therefore, to specify the exact proportions of each of the two essential compounds.

The cement is especially adapted for moulding those objects which require an extreme delicacy in the lines of the cast, such as engraved blocks and plates, formes of printing type, photographic plates, &c. Under the influence of gentle heat, it sets in a few minutes, and then resists perfectly both pressure and heat. When set it is also a very good substitute for

natural lithographic stones, and it can replace them for many practical purposes. It can also be used for artistic reproductions, such as for facsimiles of terra-cotta, whose colour and sonorous quality it possesses; though setting to great hardness in a few minutes, it does not shrink.

Although great rapidity of setting is claimed for this cement, the writer has had very varying success with this cement (compounded in various proportions), for not one sample set under four hours, and then very slightly harder than when first made. Even when sulphur, lime, sal ammoniac, or zinc oxide were added in addition, nothing remarkable about the adhesive quality of the compound exhibited itself. The best results were obtained when sulphur or lime was added as an ingredient, and then only when the cement was warmed.

Japan Gold Size (*Wholesale manufacture*).

3½ gallons linseed oil, 1½ lb. litharge, 1½ lb. redlead, 9½ lb. sulphate of iron, 5 lb. gum anime, 8 gallons turpentine.

Japanese Cement.

Mix the best powdered rice with a little cold water; then gradually add boiling water until a proper consistence is acquired, being careful to keep it well stirred all the time; lastly, it must be boiled for one minute in a clean saucepan or earthenware pipkin. This glue is beautifully white and transparent, for which reason it is well adapted for fancy work which requires a strong and colourless cement.

Jet, Cement for.

The only article used for cementing jet is shellac. Warm the broken edges before applying the shellac. Should the joint be in sight, by smoking the shellac before applying it, it will be rendered the same colour as the jet itself.

Kaseleim.

This compound of cheese and lime is used in the German cantons of Switzerland for laying floors, making blocks for hand printing cotton and tapestry goods, and other like purposes. The material sets so rapidly that it is necessary to mix it as the work goes on, which entails trouble and necessitates a certain knack in its use.

A Swiss chemist has invented a preparation of lime and

skim-milk, to which he gives the name of Kaseleim Pulser, whereby these inconveniences are avoided.

Fill a bottle to one-fourth of its height with damp caseine; then fill the flask with silicate of soda, and shake frequently until the caseine is dissolved.

Keene's Marble Cement.

This celebrated cement consists of baked gypsum, or plaster of Paris, steeped in a saturated solution of alum, and then recalcined and reduced to powder. For use mix up with water the same as plaster of Paris. This important cement will not stand the weather, but is admirably adapted for applying as a stucco.

Leather Ornaments on Metal, To Fasten.

Digest 1 part of crushed nutgalls for six hours with 8 oz. distilled water, and strain the mass. Soak glue in its own weight of water for twenty-four hours, and then dissolve it. The warm infusion of nutgalls should be spread upon the leather, and the glue on the roughened surface of the warm metal. The moist leather is pressed upon it, and then dried, when it adheres so that it cannot be removed without tearing.

Liemen's Cement.

12 parts of black iron-rust, or iron filings, and 100 parts of sulphur.

Washed with a little water or lead in crocks, and melted by heat.

Linseed Oil Cement.

This cement is used hot for joining stone, &c.

2½ parts linseed oil, 3½ parts litharge, 25 parts finely-powdered burned lime.

Mix to a paste and use like mortar.

Litharge Cement.

1 oz. litharge, 1 oz. plaster of Paris, ½ oz. finely-powdered resin, boiled linseed oil to which driers have been added.

Mix the solids together, and then make into a paste with the oil. Beat the paste well, and let it stand for four or five hours before using. Soda silicate or chalk may be added for some purposes.

Litharge and Glycerine Cement.

This cement has been referred to under "JANNIN'S CEMENT." When the litharge is finely powdered and mixed with concentrated glycerine a cement is formed which unites wood to iron with great tenacity.

London Cement.

The cement sold under this name is used for joining broken glass, china, wood, &c. It is made by taking four pieces of Gloucester cheese, and boiling it three times in water, each time allowing the water to evaporate, and mix the paste left with dry quicklime.

Lutes.

A lute is a tenacious and fluid composition, becoming solid on drying. Employed to secure the joints of vessels intended to be subjected to influences such as heat, water, steam, acids, and gases, and prevent the escape of liquid or volatile bodies.

—Dihl's Lute.

This is a mixture of boiled linseed oil, litharge, and powdered china clay, the whole being made into a paste and applied with a trowel. The surfaces of the joint must be previously thoroughly cleaned and dried.

—Lute for Glass.

The following lute is used for coating glass vessels to protect them from injury during exposure to the fire. Make pipeclay and horsedung into a paste with water, and apply the compound by spreading it on paper. Shredded tow or plumbago may be substituted for the horsedung.

—Lute for Retorts (Boyle's).

Pound into a mortar some fine quicklime and scrapings of cheese, and mix into a soft paste with water; spread on a linen rag, and apply it as a plaster.

—Lute for Water Gutters.

1 part tar, 1 part tallow, 1 part fine brickdust. Warm the tar and the brickdust, then put the tallow into the tar, and add the brickdust, and well mix the whole. This should be used hot.

—**Lute for Wooden Vessels.**

Calcine separately lime, clay, and oxide of iron, reduce each to a fine powder. Then well mix them by sifting through a sieve, and put in a well-corked bottle; and when wanted for use make up with the requisite quantity of water.

—**Lutes of Various Kinds.**

No. 1.—Take equal parts of linseed meal and whiting, and make into a stiff paste with water. This soon becomes very hard and tough.

No. 2.—Fresh slaked lime made into a paste with strained bullock's blood or size. Used with a trowel.

No. 3.—Plaster of Paris made into a paste with water, and at once applied.

This bears nearly a red heat, becomes rather porous and friable. Use screws or clamps.

No. 4.—Powdered clay or whiting made into putty with water and boiled linseed oil. This is commonly known as fat lute.

No. 5.—A mixture of powdered clay and ground bricks made up with water or a solution of borax. This is used for joining crucibles, &c., which are to be exposed to a strong heat.

No. 6.—Pipeclay and horsedung made into a paste with water as a coating for glass vessels, to preserve them from injury from exposure to the fire.

This composition is used by pipemakers, and will stand untarnished the greatest heat of their kilns for twenty-four hours. It is applied by spreading it on paper.

No. 7.—This is similar to the last, but shredded tow is used instead of horsedung. This lute is used for the joints of small vessels, as tubes, &c., especially those of glass or earthenware. Pieces of vulcanised indiarubber tubing slipped over and tied above and below the joint are very convenient substitutes for lutes. Flat rings, or washers, of vulcanised rubber are excellent for still-heads when the parts can be pinched together by clamps.

Marteaux and Roberts's Cement.

100 parts pyrolusite (sesquioxide of manganese), 12 parts graphite, 5 parts whitelead, 5 parts redlead, 3 parts clay, 8 parts boiled linseed oil.

Mix all the solids by powdering and sifting, then add 1 part of the oil to 7 parts of the mixture. Make into a paste and pound it up, and repeat this operation several times.

Martin's Cement.

This cement is manufactured in the same way as Keene's (p. 140), only carbonate of soda or carbonate of potash is used as well as alum, and the burning is carried on at a higher temperature.

Massiat's Cement.

Melt rubber with 10 to 20 per cent. of tallow or beeswax, and gradually add finely powdered quicklime. Used to cover bungs.

Meerschaum, Cement for.

No. 1.—Take some garlic and crush it, in order to form a kind of dough, rub over the broken pieces of meerschaum with it, and reunite them by pressing them very closely, bind them with iron wire according to the strength of the pieces, and finally boil them for half an hour in a sufficient quantity of milk. Caseine and quicklime cements can also be employed for the same purpose.

No. 2.—Dissolve caseine in a solution of water-glass (silicate of soda), and stir with it calcined magnesia, and use at once; or fresh cheese may be boiled in water and mixed with slaked lime and water, the proportions being 10 parts cheese, 20 parts water, 2½ parts lime, 2 parts wood ashes.

Meerschaum, Caseine Cement for.

Caseine, water-glass (silicate of soda), magnesia calcined, fine powder.

Dissolve the caseine in the water-glass, and stir in quickly the magnesia powder, and use at once, as the cement very soon hardens. If genuine meerschaum powder be mixed with the magnesia before adding that ingredient a mass closely resembling genuine meerschaum is obtained.

Mica, Cement for.

A coloured cement for joining sheets of mica is prepared as follows:—

Soak clean gelatine in water, and when swelled squeeze out the excess of water by pressure between a cloth, then melt the

gelatine by the heat of a water bath, and stir in just enough proof spirit (not to excess) to make it fluid. To each part of this solution, while stirring, add ¼ oz. of gum ammoniac and 1½ oz. gum mastic dissolved in 4 oz. of rectified alcohol. Put the mixture into bottles, and when required for use stand the bottle in hot water to melt it.

This cement resists cold water.

Modelling Wax.

Melt carefully (so as not to burn it) over a moderate coal fire 2 lb. of yellow beeswax, add 4½ oz. of Venice turpentine, 2 oz. of lard, and 1¾ lb. of elutriated bole, and mix the whole thoroughly; knead several times with the hands. The wax should be melted at such a low temperature that no bubbles appear on the surface.

Mohr's Cement.

This consists of equal parts of brick and litharge made into a paste with linseed oil, and dusting fine sand over the lute after applying it, then drying in the oven.

Moulds (Elastic) for Impressions in Relief.

Copies in very high relief can be prepared from 20 parts of glue and 2 of brown rock-candy. Both substances are dissolved in sufficient hot water to form a jelly on cooling. After the elastic moulds have been prepared they are used as a matrix for the stiff moulds by pouring into them a liquid mixture of 12 parts yellow wax, 12 parts mutton suet, and 4 parts resin. This mass on cooling becomes very solid.

Boil 2½ gallons of the linseed oil for two hours, then add gradually and in small portions at a time the litharge, redlead, and sulphate of iron, keeping the oil boiling all the time, and stirring from the bottom of the pot. It is advisable to have a large iron ladle ready to cool the mass down, if it should appear to rise too high, by ladling a part of it into an empty pot. After boiling the oil for about three hours melt 2¼ lb. gum anime, and heat ½ gallon of raw linseed oil; let it boil until clear, then cool for a few minutes, and add into the first oil. Wash out the pot in which the gum has been melted, and melt 2¼ lb. more of gum anime, and heat ½ gallon more of oil in the same manner as before, and add that, also, to the first oil. Now urge the fire in the furnace, but keep it well in front, so that it can

be drained at a moment's warning. The gold size will soon throw up a frothy scum on the surface, which must be constantly kept down by stirring with a ladle, and never be allowed to rise higher than four inches below the edge of the pot. After boiling for about five hours it will commence to become stringy, but boiling must be continued until it hangs to the ladle and drops in lumps. Now take the size from the fire, and cool it as quickly as possible, and when cool enough mix with it 8 gallons of turpentine, but do not stir until all the turpentine is in and the froth on the surface has disappeared, and then strain as quickly as possible.

Muirhead's Cement.

3 parts Portland cement, 3 parts sharp sand, 4 parts blacksmiths' ashes, 4 parts resin.

Melt the resin, and stir in all the ingredients.

Oil Cement Paint for Felt Roofing.

2 parts washed graphites, 2 parts red ochre, 16 parts cement, 16 parts baric sulphate, and 6 parts plumbic oxide (all by weight).

Boil all the above in oil varnish prepared in the following manner. Boil 100 parts by weight of linseed oil, with 5 per cent. of pyrolusite (sesquioxide of manganese), in a copper boiler for eight hours. Then dissolve 10 parts by weight of flower of sulphur and 20 parts by weight of French pitch in the above oil varnish, and filter the mixture before it is cold. 25 lb. of oil cement colour, and 1½ gallons of linseed oil varnish or linseed oil for reducing the paint, are sufficient to give two coats to 1,000 square feet of surface. The first coat, while still wet, is uniformly covered with fine dry sand sifted on the surface; it should be done during the painting, so that the workman is not obliged to slip on to the wet paint. Remove the free sand with a brush before giving a second coat, which apply in eight days' time. The second coat need not be sanded.

Oil and Sulphur Cement.

When 1 part of sulphur and 12 parts of oil are heated together a solution like molasses is produced; when 4 parts of sulphur to 12 of oil are used a mixture like putty is produced. To suc-

cessfully produce them take an iron ladle, such as is used for melting lead, and fill it not more than one-third full, and place it over a clear fire. Owing to a quantity of water being held in the oil by the vegetable matter it will begin to seethe, and if not closely watched boil over into the fire. After a little while it will subside, the surface remaining placid, with now and then little flickers of smoke flitting across the surface. The sulphur used must be either roll brimstone or the crude sublimed, *i.e.* not washed or treated with acid. If the *roll* be used reduce it to a powder, and mix by degrees; stir all the time until incorporated.

Oil-proof Cement.

The hardest cement is produced by triturating 50 grm. (1 gramme is equal to 15·43 grains) of litharge with 5 c.c. of glycerine. If more glycerine is used the mass hardens much more slowly and imperfectly. The small quantity of glycerine, however, makes it impracticable to prepare large quantities of the element at a time. For this purpose it will be necessary to take more glycerine. The most favourable results are obtained by adding 2 volumes of water to 5 volumes of glycerine (sp. gr. 1·240). 6 c.c. of the liquid are incorporated with 50 grm. of litharge. This mass requires a shorter time than any other proportions to produce a hard cement, ten minutes only being required to harden moderately, while after ten hours it becomes harder than any mixture containing glycerine and litharge alone, but after a few days the latter compound (prepared without water) overtakes the former in hardness and remains so. If a cement which rapidly hardens, and still has considerable firmness, is desired it is advisable to use water with the glycerine.

Patent Fuel, Agglutinant for.

This compound, used for the agglomeration of coal-dust and the manufacture of patent fuel, consists of coal-tar, gluten, and starch. The quantities of these substances vary according to the quality and property of coal-dust. About 2 per cent. of this mixture (say, containing 2½ parts tar, 1 part gluten, ½ part starch) would be suitable for coal-dust of an average quality of bituminous coal.

Petroleum, Cement to withstand Action of.

Dissolve 5 parts of shellac, 1 part of turpentine, 15 parts of petroleum.

This cement is fairly elastic.

Potato Paste.

This composition consists of potatoes boiled in water, or by steam, until done. They are then mashed fine and mixed with sawdust, peat, dust, or pulverised tar, and worked into a pliant dough.

Putty Wax.

This composition is for use on leaky casks, bungs, &c.

4 parts yellow wax, 2 parts tallow, 1 part spirit of turpentine, 6 parts solid turpentine (colophony).

Melt the wax and solid turpentine over a gentle fire, and then add the tallow; and, when entirely melted and well incorporated, remove the vessel away from the fire or source of heat, add the turpentine, and allow the compound to cool before using.

Red Cement.

This cement is used for uniting glass to metals.

5 parts black resin, 1 part yellow wax, 1 part red ochre or Venetian red, finely powdered and thoroughly dry.

Melt the resin and wax, and stir in the red pigment.

For use, melt the cement, and also warm the surfaces to be joined, before applying the cement; it will then adhere much better than if the surfaces are cold.

Redlead Cement.

This preparation is used for cementing the joints of metal pipes.

It is made by mixing redlead with linseed oil to a paste.

Rice Cement.

This preparation is very white and dries nearly transparent. It is capable of bearing a very high polish, and is very durable. It is in every respect far before the common paste made with wheat flour or starch; it may be formed also into a plaster.

It is made by mixing rice flour intimately with cold water, and then gently boiling it until a beautifully white preparation results.

Rubber Cements.

No. 1 *a*.—Dissolve guttapercha in carbon bisulphide until a thick solution is made.

b. Dissolve sulphur in a separate portion of bisulphide of carbon.

Brush over the parts to be cemented with the solution *a*, and press the pieces together. When dry brush over the parts with the solution *b*.

No. 2.—1 part shellac powdered, 10 parts strong ammonia.

Allow the shellac to soften in the ammonia in a vessel with the stopper out. In three or four weeks the mass will have decreased in volume and be semi-fluid. This cement softens the rubber surface, but when the ammonia has evaporated a good indestructible joint results.

—Rubber Cements.

CAUTION IN MAKING.—*These cements are very useful, but owing to the inflammable nature of the components, great care should be taken to guard against fire while preparing them.* They should never be prepared near a naked flame (and hence not by night), as the carbon bisulphide, naphtha, or chloroform used to dissolve the rubber is very volatile, and the vapour given off permeates the air until, nearing a source of light, the whole air becomes one vivid sheet of flame. Vessels which are used should be closed, and if possible put out of doors. If heat is required to assist the solvent action, use a sand or hot-water bath, but on no account bring near a fire. A hot plate or pieces of wire gauze surrounding the flames is the best source of heat to employ.

Rubber, To Cement Hard.

Dissolve bleached shellac in carbon bisulphide. Apply this cement, and when dry brush over carbon bisulphide in which sulphur has been dissolved.

Rubber, Cement to Mend.

Melt together equal parts of pitch and guttapercha, then

add linseed oil in which litharge has been dissolved. Melt all until well mixed, using no more of the linseed oil than is necessary. Apply the cement warm.

Rubber on Wood and Metal, Cement to Fasten.

As rubber plates and rings are now almost exclusively used for making connections between steam and other pipes and apparatus, much annoyance is often experienced by the impossibility or imperfectness of an air-tight connection. This is obviated entirely by employing a cement which fastens equally well to the rubber and to the metal or wood. Such cement is prepared by a solution of shellac in ammonia. We have already given the formula for preparing such a cement. It is this: Put powdered shellac into a wide-mouthed bottle, and pour on it about ten times its weight of the strongest ammonia, and let the shellac digest for a month or more; a slimy mass is obtained, which is the cement required. This cement is impermeable to gases and fluids, but it dries somewhat slowly when assisted by heat to expel the ammonia.

Schuler's Cement.

Melt 1 part of wax and 3 parts of shellac, and work into the mixture while still warm 2 parts of guttapercha cut fine.

Seal Engravers' Cement.

To fix the pieces of metal while cutting, and also to secure seals and tools in their handles, common resin and brickdust melted together is employed. This cement grows harder and improves every time it is melted.

Serbat's Linseed Oil Mastic.

6 parts lead sulphate, 1 part linseed oil, 6 parts powdered pyrolusite (sesquioxide of manganese).

Mix the lead salt with the oil, and then gradually add the sesquioxide.

Shellac Cement.

No. 1.—Simple shellac, melted and moulded into sticks the

size of a lead-pencil, is commonly sold for a cement with strong water, acids, oils, &c. (spirits dissolve this body). This cement is very good to cement broken glass, porcelain, &c., especially as the objects are again ready for use immediately when cold. But it is not adapted for flexible objects, as it cracks, and also will not stand heat. The objects to be cemented are first warmed till they melt the shellac brought in contact with them.

No. 2.—Shellac dissolved in alcohol or naphtha forms a good useful cement for broken glass, china, earthenware, &c.

Soft Cement.

This cement is particularly useful for sticking things together temporarily.

It is prepared by melting yellow beeswax with its own weight of turpentine, and colouring the mixture with finely powdered Venetian red or other red oxide of iron. When cold this mixture has the hardness of soap, but is easily softened and moulded with the fingers.

Soluble Glass Cements.

No. 1.—The following cement is useful for domestic and industrial purposes. This cement hardens between 6 and 8 hours. It is prepared by stirring chalk into a solution of soluble glass (*i.e.*, silicate of soda), 930° B., until the mixture is fine and plastic.

No. 2.—This cement is prepared in like manner to No. 1, but pulverised or levigated stibnite (grey antimony or black sulphide of antimony) is used instead of chalk. The product is a dark cement, which when polished with an agate will present a metallic appearance.

No. 3.—When pulverised cast iron is used instead of chalk, a gray cement results.

No. 4.—Zinc dust, so called zinc gray, forms an exceedingly hard grey cement, which, after burnishing, will exhibit the white and brilliant appearance of metallic zinc. This cement may be employed with advantage in mending ornaments and vessels of zinc, sticking alike well to metal, wood, and stone.

No. 5.—When carbonate of copper is used instead of chalk a bright green cement results.

No. 6.—Sesquioxide of chromium produces a dark green cement.

No. 7.—Thénard's blue (cobalt blue) gives a blue cement.

No. 8.—Minium (redlead) produces an orange-coloured cement.

No. 9.—Vermilion, a splendid red cement.

No. 10.—Carbon red, a violet cement.

Sorel's Cement.

Mix commercial zinc-white with half its bulk of fine sand, adding a solution of chloride of zinc of 1·26 sp. gr., and rub the whole thoroughly together in a mortar. The mixture should be used at once, as it hardens very quickly.

Stephenson's Oil Cement.

This cement consists of 2 parts litharge, 1 part unslaked lime, 1 part fine sand, hot linseed oil.

The whole made into a paste and used immediately. The amount of oil used is 3 parts when the other ingredients are taken in the following proportions :—20 parts litharge, 10 parts lime, and 10 parts sand.

Stick-All.

This familiar cement is simply a silicate of potassium. It forms a very valuable cement for mending statuary. It suffices to brush the surfaces with the solution and to press them firmly together.

Stratena.

This is a very well-known household cement. It is said to be prepared as follows :

Dissolve 6 parts white glue in 8 parts acetic acid, and then add this solution to another compound of 1 part French gelatine in 8 parts water. After mixing, add 1 part shellac varnish.

Strieda's White Zinc Cement.

Rub up oxide of zinc with turpentine, and add, stirring continually, for every drachm of zinc oxide 1 oz. of a solution of

dammar in turpentine, of the consistency of thick syrup. This gives a white cement like Ziegler's.

For a red cement take, instead of zinc, cinnabar, and take 2 drm. of the metal for each oz. of the dammar solution. If the cement has become too thick with age, dilute it with turpentine, ether, or chloroform.

Sugar and Lime Paste.

This preparation has all the properties of a solution of gum arabic, possesses great adhesive power, and dries to a lustrous mass.

4 parts white cane sugar, 12 parts water, and 1 part slaked lime.

Dissolve the sugar in the water, bring it to a boil, and then pour in the lime. Allow the mixture to stand for a few days in a covered jar, and give an occasional stir. When it has settled, pour off the thick fluid from the excess of lime.

Sulphur Cement for Porcelain.

7 parts sulphur, 5 parts white pitch, 1 part bleached shellac, 2 parts mastic resin, 2 parts gum elemi, 7 parts glass meal (*i.e.* finely sifted glass-dust).

Melt all together but the last, and stir that well into the melted mass.

Sumatra Caseine Cement.

The chief cement used in the island of Sumatra is made from the curd of buffalo milk, prepared in the following way: The milk is left to stand till all the butter has collected at the top. The latter is then removed, and the thick semi-fluid mass left is termed the curd. This is squeezed into cakes and left to dry, by which it becomes as hard as flint. For use some is scraped off, mixed with quicklime and moistened with milk. It holds exceedingly well, even in a hot, damp climate, and is well adapted for mending china articles.

Tolu Balsam Cement

2 parts tolu balsam, 1 part Canada balsam, 2 parts saturated solution of shellac in chloroform.

Chloroform enough to bring the mixture to a syrupy consistence. This cement is used by microscopists.

Tortoiseshell, Cement for.

No. 1.—30 parts shellac, 10 parts mastic, 2 parts turpentine, 125 parts alcohol (90 per cent.).

Mix and digest all together.

No. 2.—15 parts mastic, 45 parts shellac, 3 parts turpentine, 175 parts alcohol (90 per cent.).

Digest as in No. 1.

No. 3.—5 parts mastic, 15 parts shellac, 1 part turpentine, 60 parts alcohol (90 per cent).

Alcohol of 90 per cent. is meant for methylated spirits where cheapness has to be considered.

Trees, Cement for Protecting.

The following cements are used to protect injured trees :—

No. 1.—2 parts yellow ochre, 1 part wood ashes (sifted), 10 parts whitelead, 2 parts Venice turpentine, linseed oil.

Mix with the oil into a putty.

No. 2.—1 part sifted wood ashes, 2 parts yellow ochre, 10 parts ordinary whitelead, 2 parts Venetian turpentine, linseed oil.

Mix the solids into a thin paste with enough linseed oil for that purpose.

Apply the mixture twice to the injured parts of the tree you wish to prevent decaying.

Turkish Plaster, or Hydraulic Cement.

This cement is used to coat water-pipes of clay or metal.

150 lb. fresh lime (reduce to powder), 15 quarts linseed oil, 1½ to 3 oz. of cotton.

Gradually mix the oil and cotton into the lime until the mixture is of the consistency of bread dough. Mix in a wooden vessel. Dry the mixture, and when used form a paste by mixing with linseed oil. Put the cement on in successive coats.

Universal Cement.

No. 1.—This cement holds equally well upon wood, stone, porcelain, ivory, leather, parchment paper, feathers, wool, cotton, linen, &c., 1 part common pitch, 1 part guttapercha.

Melt the two ingredients together in an iron saucepan, mix

well by stirring, and then keep the mixture fluid either under water or in a dried and hard condition.

No. 2.—Curdle skim-milk, press out the whey, and dry the curds by a gentle heat, but as quickly as possible; when it has become quite dry, grind it to a powder in a coffee or pepper-mill and mix it with $\frac{1}{20}$th of its weight of finely-powdered quicklime and a piece of camphor the size of a pea, also reduced to powder, to every ounce of the mixture. Keep it in wide-mouth 1-oz. vials, well corked. For use, make it into a paste with a little water, and apply it immediately.

Vegetable Cement.

No. 1.—Mix 10 parts of gum arabic with 1 part calcic nitrate, and make into a paste with 10 parts water.

No. 2.—Or else use 2 parts of calcic nitrate, 20 parts gum arabic powder, and 25 parts water.

Venice Cement.

Mix glue with a quarter its weight of Venice turpentine. The mixture forms a compound which will cement glass with metals or wood.

Vulcanised Caoutchouc, Cement for.

3 oz. Stockholm pitch, 3 oz. American resin, 6 oz. crude caoutchouc, 12 oz. oil of turpentine.

Heat the above ingredients all together, stirring them well. More oil of turpentine can be added to the compound if found too thick for the desired purpose.

Roughen the surface of the materials to be cemented with either pumice stone or emery paper before applying the cement.

Vulcanite, To Cement.

No. 1.—1 part sulphur, 3 parts pure caoutchouc, 6 parts alcohol, 100 parts bisulphide of carbon.

Mix the alcohol and bisulphide of carbon, and then dissolve the caoutchouc and sulphur therein, and evaporate to the consistence of a thin paste. Join the fractured edges with this, and heat the whole to about 310° F. for four hours.

No. 2.—Used for cementing vulcanite teeth. Mix dry

caoutchouc with half its weight of flower of sulphur, and thoroughly knead the mixture on a plate of warm metal.

Heat the teeth to a temperature of about 212° F., join the fractured edges with a little of the caoutchouc dough moistened with a drop or two of bisulphide of carbon, and expose the whole to a temperature of about 200° F. for two hours. At the expiration of that time raise the temperature to 300° F., and maintain it constantly at this for four hours more. When cool the joint will be found firm, and may be trimmed with a sharp knife.

Wash-basins, Cement for.

2 parts glass meal (finely powdered glass sifted), 2 parts litharge elutriated, 1 part linseed oil varnish.

Wet the powders slightly with the oil, heat and gradually add the rest. Do not use the basin for four days. Glass meal can be made by heating glass and throwing it in cold water, grinding the fractured pieces, and washing by stirring up in water and allowing the finer particles to float off into a second vessel; and collect this fine powder when sufficient has settled in the vessel, and sift it through a very fine sieve.

White Cement.

Mix in a well-stoppered bottle 10 drm. chloroform with 12½ drm. unvulcanised caoutchouc in small pieces. The solution is easily applied, and when finished add 2½ drm. of mastic and let the whole macerate from eight to ten days, shaking the mixture from time to time, but without heat. A perfectly white but very adhesive cement is thus produced. This compound is made on the same principle as the cement greatly in vogue amongst florists for making permanent bouquets.

White Cement for Large Objects (Wollaston's).

1 oz. beeswax, 4 oz. resin, 5 oz. plaster of Paris.

Melt together.

To use this cement, warm the edges of the article and use the cement warm.

Zinc-white Cement.

No. 1 —*German Formula.*—1 part mastic, 2 parts dammar,

3 sandarac, 4 parts Venetian turpentine, 5 parts turpentine, 6 parts benzole, 7 parts zinc-white.

The mastic, dammar, and sandarach resins are powdered, while the Venice turpentine, ordinary turpentine, and benzole are put into a bottle, and then the powdered resin put in, and the whole shaken up and left for the resin to dissolve. Afterwards filter through cotton wool bound on the neck of a glass funnel, and then rub up this varnish with sufficient zinc-white to form a cement. Dilute with benzine if necessary.

No. 2.—*English Formula.*—Powder 1 part gum dammar and 2 parts mastic, and dissolve them in 3 parts benzole in a well-corked bottle with occasional shaking. Then filter as in the German formula for this cement, and mix carefully into a mortar with zinc-white.

Waterglass having fine whiting and impure zinc (zinc-grey) stirred in forms an excellent cement, and receives a high polish.

INDEX.

BORROWER'S NO.	ISSUE DATE	BORROWER'S NO.	ISSUE DATE

BORROWER'S NO.	ISSUE DATE	BORROWER'S NO.	ISSUE DATE

Borrower's No.	Issue Date	Borrower's No.	Issue Date